ACUSON 128XP COMPUTED SONOGRAPHY SYSTEMS

Service Manual

acuson
COMPUTED SONOGRAPHY

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Preface

The Acuson 128XP® Computed Sonography System is a mobile, stand-alone, self-contained ultrasound system specifically designed for diagnostic medical applications. The system is bus oriented and expansion slots are provided to allow upgrades to the system's capabilities. Data is displayed on a video monitor. Recording devices including videotape, strip-chart recorders and multi-image cameras to allow permanent retention of patient data are available.

The Acuson 128XP design is based on the use of modular, functionally-isolated printed circuit boards and subassemblies that simplify on-site service and repair. In most cases, on-site maintenance is accomplished by removing and replacing printed circuit boards (PCB's) or subassemblies.

The Acuson 128XP is shipped in a special container (See User's Manual). No post-delivery adjustments or calibrations are required for equipment operation.

The purpose of this manual is to familiarize service personnel with the system's basic operation for maintenance and troubleshooting. Service personnel are expected to be familiar with the use of basic test equipment (oscilloscope, DVM, etc.), basic ultrasound theory and the architecture and theory of operation of the Acuson 128XP.

Scope of Manual

This manual should be used when servicing all Acuson 128XP/10, 128XP/5, 128XP/E, 128/10, and 128/5 systems. For simplification, these systems will be referred to generally as Acuson 128XP.

Systems referred to as Acuson 128/10 or 128/5 have been upgraded to XP capabilities in the field. Their operation and circuit boards are covered in this manual. Fan and power supply operation, filter and isolated accessory outlet location are documented in the appropriate earlier service manual.

The Acuson 128XP/E was designed to emulate the Acuson 128 system. The chassis of the XP/E is identical to the XP/10 and XP/5. However, the XP/E operates at a different software revision level and does not support XP capabilities (unless an XP upgrade is performed in the field). Refer to service manual 23151 for Performance Verification section.

For service information about earlier systems use service manual part number 19018 or 23151.

This manual is arranged in sections corresponding to the major functional groups within the Acuson 128XP. Each section provides information about the overall architecture, troubleshooting techniques and details about the subassemblies pertinent to that functional group. These sections are:

Section 2 - System Overview

Section 3 - Scanner

Section 4 - Scan Converter

Section 5 - Power Supplies

Additional sections are provided which contain routine maintenance information as well as reference materials. These sections are:

Section 6 - Preventative Maintenance

Section 7 - Performance Verification

Section 8 - Parts Lists

Section 9 - Engineering Drawings

NOTE: The sections on the PCB's reference key signals by name under the headings "Signals In" and "Signals Out." This information is provided only to communicate key aspects of inter-board signal flow and should not be used in any other way. The exact physical locations of the signals are generally not provided. It is neither necessary nor advisable to attempt to locate and monitor these signals directly.

PCB Type, Version and Revision Identification

Printed circuit boards are identified by board type, version and revision level. The board type indicates the board's major function. The type is abbreviated into a three-letter acronym, such as STG for the Scanner Timing Generator board.

Version numbers are used to distinguish significant design changes of a board type. The new version is distinguished from the old by appending a number to the three-letter type identifier. In the case of the STG board, a design change was made to add support for Doppler. The earlier version boards are called STG 1; those supporting Pulsed Doppler are STG 2. Later changes produced the STG 3 and the STG 4. All these versions are referred to generally as STG boards. Newer version boards may always be used in place of older versions.

The type and version identifiers are etched in the board's copper foil.

All boards also carry revision level marking which identifies minor changes. Any change to a board or its documentation increments its revision level. Not all of these changes are significant in the field.

Acuson uses a two-tiered identification system for revisions of released assemblies. When first released the revision level is numeric. Later, if changes are required, it becomes alphabetic. Alphabetic revision levels are always higher (later) than numeric revisions. Occasionally it is necessary to process a high priority change ahead of a previously scheduled lower priority change. This is identified by appending a number to an alphabetic revision to indicate a revision level in between two alphabetic revision levels. For example, revision "D1" is between revisions "D" and "E."

Revision levels are hand written on the board in indelible ink. They should not be confused with the PCB fabrication (bare board) revision levels, which are marked in the copper etch or the silkscreen.

For example:

STG Revision Requirements
STG 4 Rev. A required for CW Doppler, curved array and Vector™ Array.
STG 4 Rev. K required for S2194 transducer operation.
STG 3 Rev. B required for 5 MHz cardiac transducers and 7 MHz transducers.
STG 2 Rev. 6 required for Doppler.
STG 1 Rev. 5 ok in B/W, non-Doppler systems only.

In this example an STG 4 can be used in systems with 5 MHz cardiac transducers, 7 MHz transducers, Doppler systems, or in B/W, non-Doppler systems. It must be used in systems with CW Doppler, curved array, Vector Array, and S2194 transducer. Any STG 4 board marked with Revision A or higher (any letter later in the alphabet) is acceptable. Systems with the S2194 transducer require an STG 4 board marked with Revision K.

An STG 3 may be used in Doppler systems or B/W, non-Doppler systems, but may not be used in a system with CW Doppler, curved array, Vector Array or S2194 transducer. STG 3 boards must be at Revision B or higher.

STG 2 boards must be at Revision 6 or higher. Any alphabetic revision letter is acceptable.

STG 1 boards must be at Revision 5 or higher. Any alphabetic revision letter is acceptable.

Safety Precautions

The following safety precautions should be observed when servicing the Acuson Computed Sonography system:

Danger!! Lethal voltages (up to 300 VDC) are present inside the Acuson 128XP. Use caution when opening the unit. Under certain fault conditions the high voltage bus may remain charged even when the system is unplugged from the wall outlet. Furthermore, the operating temperature of some components can cause burns.

Always consult the user manual for proper operation and use of this system.

Always be sure system power is off before removing or installing any circuit board or other subassembly.

Required Facilities

The Acuson 128XP is a stable, rugged device. However, to help ensure continuous trouble-free operation, it should receive the care given to any precision instrument.

Environmental Requirements

The system's environment should be free of fumes, dirt and electrical interference (for example, brush type motors and large fields of RF energy).

The Acuson 128XP has the following specifications:

- Dimensions:
  - height: 129.5 cm (51 in.)
  - depth: 90.2 cm (35.5 in.)
  - width: 63.5 cm (25 in.)
- Weight: 229 kg (504 lb.)
- Heat dissipation: 5,000 BTU per hour

The system is designed to operate within the following limits:

- Temperature: 15° to 33°C, 59° to 90°F
- Relative humidity: up to 90% noncondensing

To provide adequate cooling maintain the following clearances when the system is in use:

- left side clearance: 15 cm (6 in.)
- right side clearance: 15 cm (6 in.)
- rear clearance: 30 cm (12 in.)

Electrical Requirements

Acuson produces systems that operate with AC line voltages of 100, 115, 220, or 240VAC ±8%. The nameplate on the back of the system indicates the AC power required for your system. The 100 and 115VAC systems usually require 15A service. However, some equipment options require 20A service. Systems with such requirements are equipped with 20A attachment plugs. Units configured for 220 or 240VAC generally require 10A service.

For optimal system performance, use a dedicated, interference-free, well grounded wall outlet. The system is equipped with a hospital-grade attachment plug. To ensure grounding reliability, connect it only to an equivalent hospital-grade socket.

CAUTION: Before having your system installed by an Acuson Customer Engineer, ensure that the electrical service is adequate. DO NOT modify the attachment plug or use an adapter; doing so may overload your building's power circuits. DO NOT use an extension cord. Doing so may cause your system to exceed leakage current requirements.

Isolated Accessory Outlets

The system has six isolated power outlets within it for connecting accessories. Two outlets are located behind the lower cart air filter to provide power to accessories in the instrument bay. Four additional outlets are located on the lower rear panel of the system to provide power to accessories located on top of the system. Plug only approved accessories into these outlets. The total power available from these outlets is 250VA. Overloading these outlets can cause an overload of the system and the wiring of your building. Failure to use isolated outlets can degrade image quality.

Note: The Acuson 128/5 and 128/10 systems have a different weldment than the 128XP/E, 128XP/5, and the 128XP/10. Refer to service manual part number 19018 or 23151 for isolated outlet location.

Leakage Current Limits

The isolated accessory outlets allow you to connect approved accessories without increasing the system leakage current.

WARNING: Connecting accessories powered from non-isolated sources may result in chassis leakage currents exceeding safe levels.

CAUTION: Plug only the proper connectors in the input and output connector sockets on the back of the system. Never apply voltage to the output connectors. Doing so can damage the machine and destroy its electrical safety features.

Transducer Care

Transducers require proper handling, cleaning, and care. IMPROPER TRANSDUCER CARE WILL VOID YOUR WARRANTY. Transducer care includes daily inspections, daily cleaning, and sterilization whenever necessary.

Handling Transducers

It is important to handle transducers properly:

- DO NOT drop the transducer. Dropping or striking the transducer against a hard surface can damage the transducer elements and the acoustic lens. The electrical safety features may also be compromised.
- DO NOT use a cracked or broken transducer. Damaged transducers present a danger of electric shock. If a transducer cracks or breaks, it must be repaired or replaced. Contact your Acuson customer engineer immediately for assistance.
- DO NOT pinch or kink the transducer cable. If the cable has any cuts or openings, there is a danger of electric shock. The transducer must be repaired or replaced. Contact your Acuson customer engineer immediately for assistance.
- DO NOT immerse the transducer in any liquid beyond the first ridge. The transducer is not watertight. Immersing it beyond the first ridge can destroy its electrical safety features. See your user manual for detailed instructions regarding the disinfection or sterilization of transducers.
- Use only approved ultrasound coupling gels and cleaning agents on Acuson transducers. Improper care will void your warranty. See "Cleaning, Disinfecting, and Sterilizing Transducers" later in this section for more information.

WARNING: DO NOT use a transducer that has been dropped or subjected to a severe shock until it has been inspected by an Acuson customer engineer. Cracks or breaks in the transducer housing and cuts or openings in the cable can damage the electrical safety features of the transducer. This can result in electric shock to the patient or the sonographer.

Inspecting Transducers

Inspect the transducer lens, case, and cable each day. Check for cracks or other damage that may allow liquids to enter the transducer. If you find any damage DO NOT use the transducer until it has been inspected by an Acuson customer engineer and either repaired or replaced.

Cleaning, Disinfecting, and Sterilizing External Transducers

There are different procedures for cleaning, disinfecting, and sterilizing transducers used externally, such as those used for transthoracic or abdominal exams, and those used internally for endocavity exams. The information provided here describes the procedure for external transducers. For information on internal transducers see below.

Important: **Based on empirical evidence, we confirm these solutions are acceptable to maintaining the Acuson safety and performance standards. Use only these solutions to maintain your system warranty and service contract status in full. Follow the manufacturers' instructions for appropriate procedures regarding the use of their products.**

Disinfecting and sterilizing solutions for external transducers include:

- Cidex® (not Cidex 7® or Cidex Plus®)
- Metricide
- Microbac
- Sporicidin

Important: **The only disinfecting and sterilizing solution for endocavity transducers is:**

- Cidex (not Cidex 7 or Cidex Plus)

Note: For information on cleaning and disinfecting procedures for internal transducers, see below

Periodically clean your transducers and transducer cables.

◆ **To clean external transducers:**

1. Unplug the transducer connector from the system.

2. Use a damp cloth that has been dipped in a mild soap and water, isopropyl alcohol, or a disinfecting solution as listed above.

OR

2. Use chlorine bleach mixed with an equal amount of water (50% bleach and 50% water). Immediately after wiping a transducer and cable with a dilute chlorine bleach solution, use water to remove any residue. Residual bleach can damage the transducer and transducer cable. DO NOT soak the transducer in bleach, even a dilute solution.

Using Ultrasound Coupling Gels

Some ultrasound coupling gels, and lotions, can damage Acuson transducers. Use of any of the following chemicals or products containing these chemicals will void your transducer warranty. Check with the gel manufacturer regarding gel contents. If you have additional questions, please contact your Acuson representative.

Agents containing the following chemicals are known to damage transducers:

- acetone
- methanol
- denatured ethyl alcohol
- mineral oil
- iodine
- any lotions or gels that contain perfume

Cleaning and High Level Disinfecting Internal Transducers

Acuson recommends that you use protective transducer covers or condoms to cover the transducer during patient exams. After each exam, regard the transducer cover and any other wastes as potentially infectious and dispose of them accordingly.

High-level disinfect the transducer prior to use and between each exam. Disconnect Endocavity Transducers from the system before cleaning, high-level disinfection, and sterilizing.

Important: **The only disinfecting and sterilizing solution for endocavity transducers is Cidex (not Cidex 7 or Cidex Plus).**

To high level disinfect the transducer before the first exam and between each exam, soak the transducer for at least 10 minutes in Cidex. Depending on the infectious nature of the patient and the potential for contamination of the transducer by body fluids, a physician may determine that a longer disinfection time is necessary. In these cases, the physician may recommend a 45-minute or longer soak in Cidex. DO NOT leave the transducer in Cidex for longer than 10 hours.

If a transducer is contaminated with blood, body fluids or other materials, always high level disinfect the transducer before scrubbing it clean. Disinfect or sterilize it again after cleaning.

After disinfecting the transducer, rinse it in sterile or high-quality tap water, depending on the use.

The transducer and cable may be submerged up to, but not including, the strain relief of the transducer connector. DO NOT immerse the the DL connector or its strain relief.

System Care

The Acuson 128XP requires proper care and cleaning. IMPROPER CARE CAN VOID YOUR WARRANTY. System care includes cleaning the air filters weekly, and proper cleaning and sanitizing of the exterior cabinet.

Cleaning and Sanitizing the Cabinet

◆ **To clean or sanitize the cabinet:**

1. Unplug the system from the power outlet.

2. Clean the cabinet with a damp cloth soaked in mild soap and water, or sanitize it using Microbac, Cidex, or isopropyl alcohol.

CAUTION: Avoid dripping any liquid into the cabinet or onto the keyboard.

Air Filter Care and Cleaning

The Acuson 128XP has two reusable air filters. The upper air filter is located on the right side of the system and the lower air filter at the rear of the system (Refer to Figure 6-1). The two filters are externally accessible.

Remove, inspect, and clean these filters at least once every week. See your user manual for detailed instructions.

Note: The Acuson 128/5 and 128/10 systems have a different weldment than the 128XP/E, 128XP/5 and the 128XP/10. Refer to service manual part number 19018 or 23151 for filter location.

CAUTION: Failure to clean the air filters can result in damage to the Acuson 128XP.

SECTION 2

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Ultrasound Basics

Ultrasound imaging is a method of viewing anatomy by displaying the reflections of high frequency sound waves on a video monitor. An ultrasound image is made up of a large number of discrete lines of echo information. These lines are generated one at a time in rapid succession. A pulse of ultrasound energy is transmitted into the body along the axis of each line by the transducer. Echoes are created when the sound wave bounces off the boundary between tissues of dissimilar acoustic impedance. After the ultrasound pulse is transmitted the transducer "listens" for echoes from points that lie along each line. The quality of the image is determined by the precision with which the ultrasound beam is focused in both transmit and receive modes and the sensitivity to reflected signals.

Echoes contain several kinds of information:

Echo amplitude

The strength of echo is proportional to relative changes in the acoustic impedance of the tissue being examined.

Position

The direction of an ultrasound line is defined by the Acuson 128XP. The position of a target on a line is determined by noting the elapsed time between the initial transmit pulse and received echo. It takes about 6.5 microseconds for sound to travel 1 centimeter. The ultrasound must travel from the transducer to the target and then the echo must return to the transducer. Therefore, an echo from a target 1 cm deep will return to the transducer about 13 microseconds after the transmit pulse.

Velocity

Just as a train whistle has a higher pitch when it is approaching than it does receding, echoes from a moving target are also shifted in frequency by the Doppler effect. By measuring the difference in frequency between the transmit pulse and the echo, the velocity of blood (or other structures) may be determined.

The Acuson 128XP is able to extract the maximum amount of available diagnostic information because of its unique architecture. Acuson's transducer has no moving parts. This eliminates noise caused by a mechanical transducer's need to steer the ultrasound beam by moving the transducer elements. Since there are no moving parts, there is no need for an integral water path nor for superfluous procedures such as degassing the transducer.

The use of 128 separate transmit and receive channels allows the system to form an exceptionally well-focused beam of ultrasound energy. During the receive cycle the transducer is continually refocused as the ultrasound echoes return from progressively deeper anatomical structures. This means that each line of information is in focus along its entire length, not just one point. Velocity information (Doppler) is enhanced for the same reasons as the 2-D image.

Acuson's hybrid analog/digital computer is referred to as the "Scanner." The Scanner may be programmed to work with a variety of specialized transducers. Each transducer has been optimized for frequency, format, dimensions and specialized uses such as intracavity applications. The Scanner automatically loads the software required to allow the Scanner to work with each transducer.

The ultrasound lines may be transmitted from the transducer in one of four formats: linear array, sector array, High Performance Curved Array, and Vector^{tm} Array (See Figure 2-1). Each of Acuson's transducers is optimized to operate in one of these formats.

In linear format, each ultrasound line is transmitted perpendicular to the face of the transducer. Therefore, all the lines are parallel and the image area displayed on the screen is rectangular.

In sector format, each line is fired in a unique direction from a common point on the transducer. The image area displayed on the screen appears as a sector of a circle with the apex adjacent to the transducer face.

In the Vector Array format, ultrasound scan lines can originate from any point on the transducer face and can be steered in any direction. The near field image width is as wide as the transducer footprint. Therefore, the Vector Array format produces a wider field of view at all depths than the sector format.

In the High Performance Curved Array format, each ultrasound line is transmitted perpendicular to the face of the transducer as in the linear format. The face of the transducer is curved, so it produces an image with a wider far field than near field. The Acuson 128XP/10 (and 128/10) systems support all four imaging formats. The Acuson 128XP/5 (and 128/5) systems support linear and sector formats.

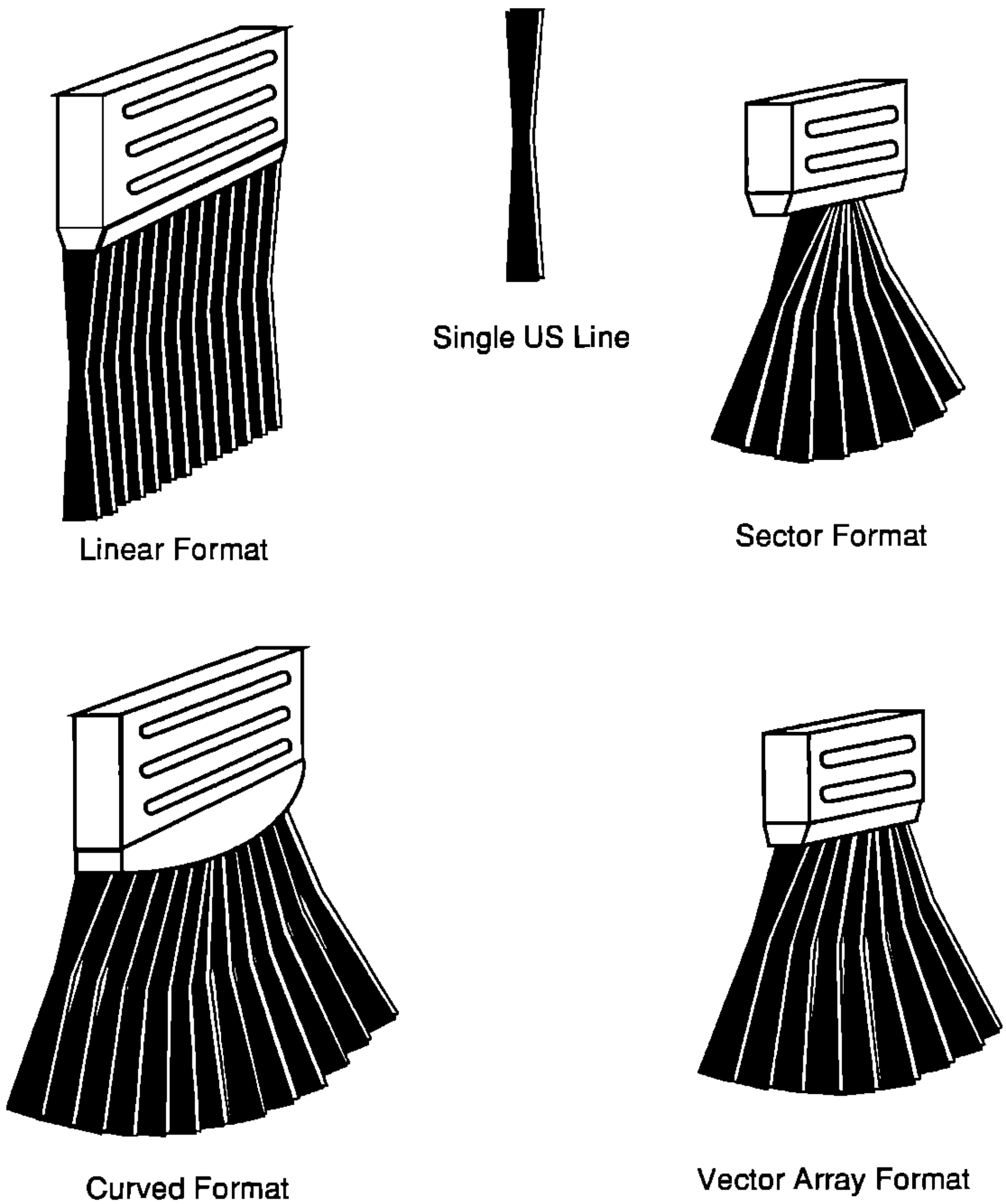

Figure 2-1. Ultrasound Scan Formats

System Architecture

For purposes of description, the Acuson 128XP may be divided into four major assemblies:

Scanner

The Scanner is the heart of the Acuson 128XP. It contains the hybrid analog/digital computer that controls timing, phase and amplitude for each of the 128 channels. Controlling these parameters allows the Acuson 128XP to transmit a tightly focused pulse of ultrasound energy from the transducer. During the receive cycle the Scanner adjusts these parameters in real time. As the ultrasound pulse penetrates the body, the Scanner continuously maintains focus at successively deeper points along the scan line. Information about the ultrasound line number, depth of scan, etc. is passed along with the analog echo signal to the Scan Converter. See the Scanner Architecture section for more information.

Scan Converter

The Scan Converter's function is to acquire the analog ultrasound signal and related information such as line number, depth of scan, transmit focal zone, etc. and form a useful image. Functions required to accomplish this include:

- digitizing the analog ultrasound information
- storing digitized ultrasound information for processing
- image postprocessing
- calculating specialized functions
- generating alpha-numeric and graphic overlays
- interfacing with front panel controls
- interfacing with recording devices (cameras, VCR's, page printers, etc.).

See the Scan Converter section for more detail.

Power Supplies

Power supplies take 115 VAC (or 220 VAC on international systems) from the wall outlet and convert it to various DC voltages. The control electronics for the power supplies are located in the power supply drawer located beneath the Acuson 128XP. See the Power Supply Configuration section for more information.

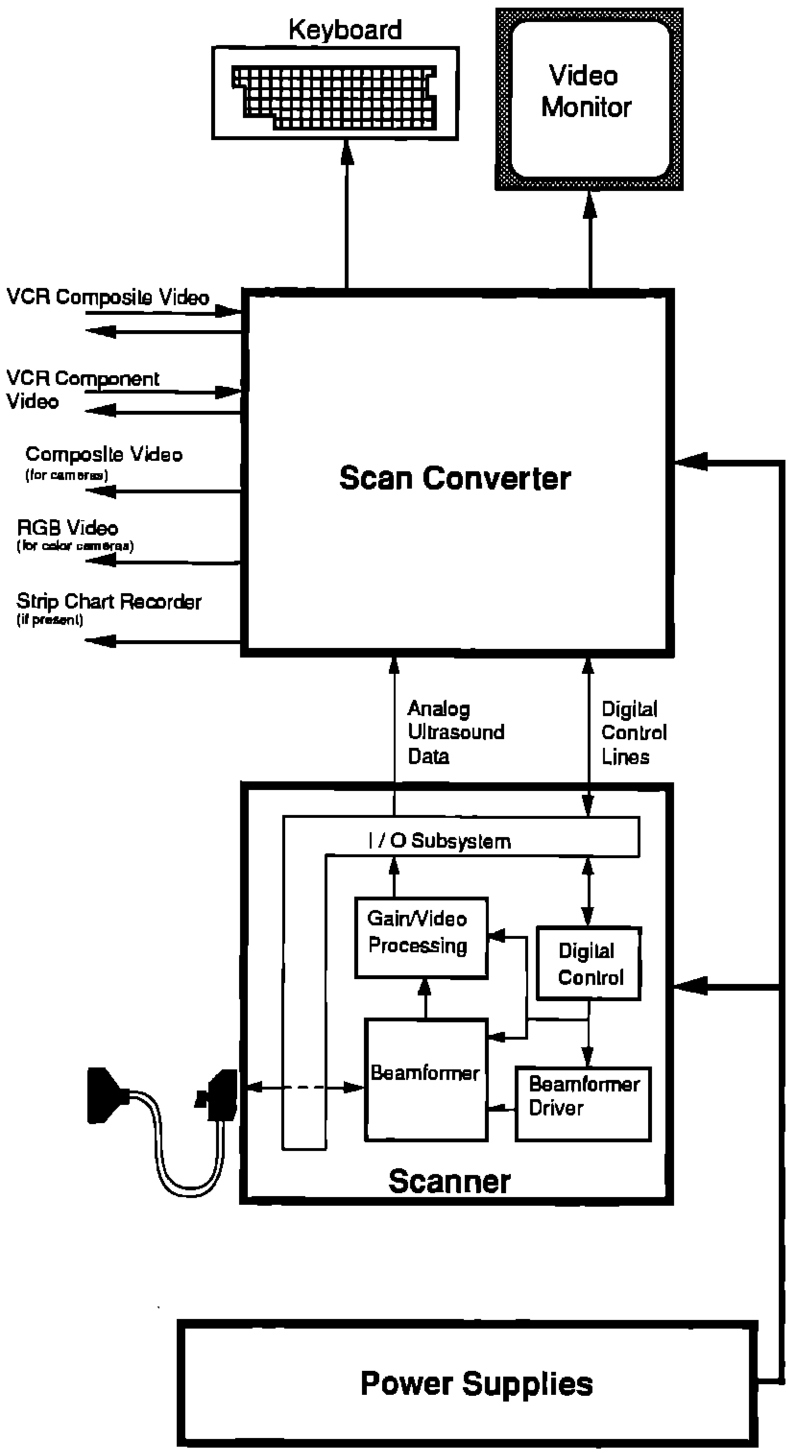

Figure 2-2. Acuson 128XP System Architecture

Transducers

Each transducer manufactured by Acuson is made up of 128 individual piezo-electric elements. These elements perform two functions. First, they receive a high voltage electric pulse from the Scanner and convert it to an ultrasound wave. Second, they convert the energy contained in the ultrasound wave echoes to an electric voltage. These 128 individual electrical signals are then processed by the Scanner.

Recording Device Interconnection

There are many different recording devices which can be interfaced to the Acuson 128XP. Figure 2-4 shows some of the recording devices available from Acuson along with the cables which connect them to the system. Earlier systems with a System Interconnect board have a different I/O panel, therefore require different cables. Refer to service manual part number 19018 for SI and I/O panel interconnections.

Note: The most recent style VCR cable is part number 24148, which is switchable between VHS (switch set to B) and S-VHS (switch set to A). The switch is located on the VCR remote connector, as shown in Figure 2-3.

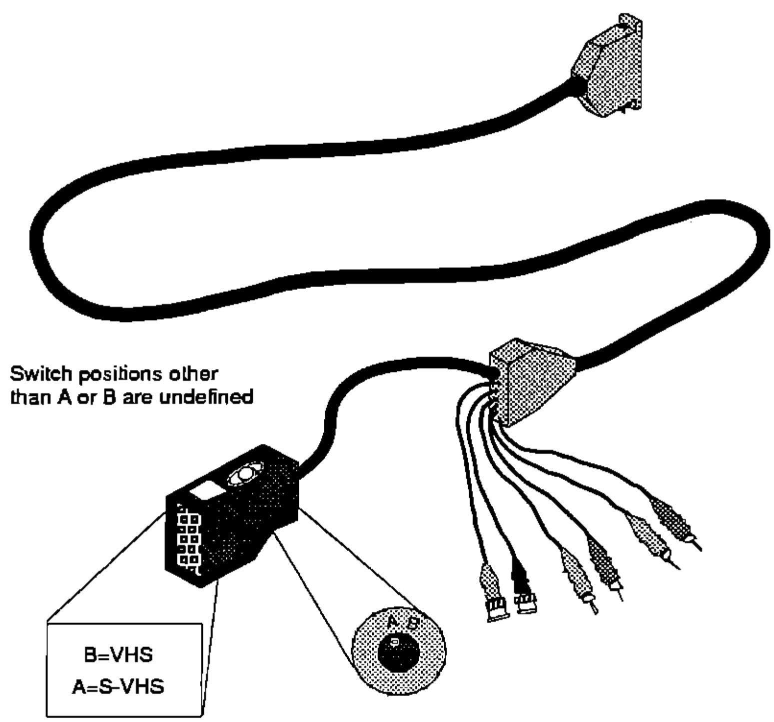

Figure 2-3. Switchable VCR Cable P/N 24148

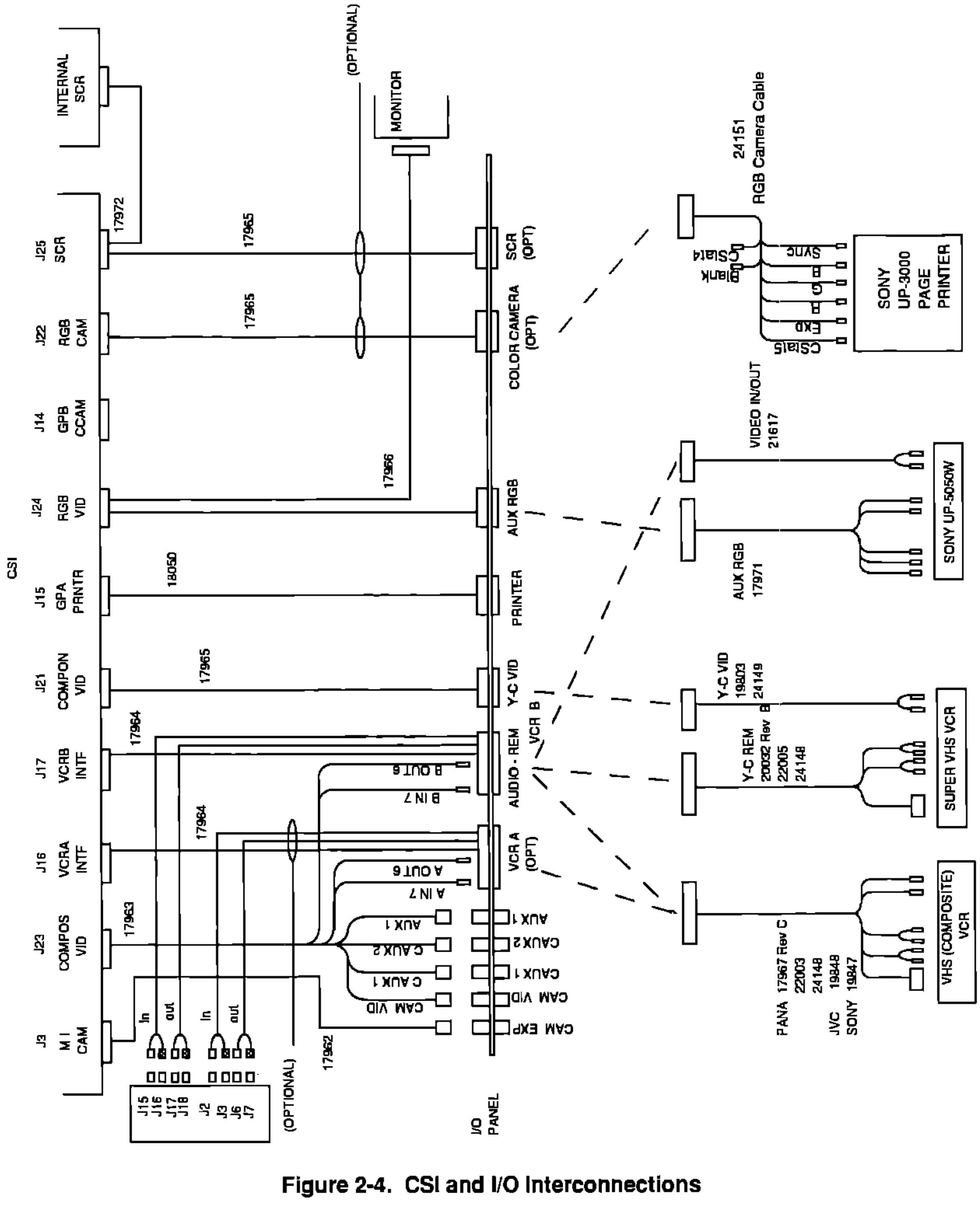

Figure 2-4. CSI and I/O Interconnections

System Troubleshooting

This section describes general procedures for troubleshooting system faults and isolating them to major system assemblies. Later sections focus on troubleshooting techniques for the Scanner, the Scan Converter, the Power Supplies and their associated subassemblies.

Troubleshooting the Acuson 128XP involves the systematic replacement of subassemblies until the cause of the fault is located. As with any troubleshooting exercise, the final proof is to replace the offending assembly and resolve the fault. The goal of the troubleshooting sections is to reduce the number of assemblies you must replace in the process of locating the fault.

Note: Repairs to the Acuson 128XP are never taken beyond the subassembly level. Even common components in an Acuson system are subjected to specific tests and performance standards before they become part of an Acuson subassembly. The completed subassemblies must pass rigorous testing and environmental procedures before they are distributed as spare parts. Any field adjustment or use of non-Acuson components may result in degraded performance and possible system damage.

Power-up Errors

When the system is first powered on, or is reset by pressing the reset button on the monitor control panel, the system performs a series of circuitry tests. If a problem is detected, a message appears on the video display. In most cases the failure message indicates a specific subassembly for replacement to correct the problem. In some cases, the failure may result from an assembly other than the one indicated, or from some combination of assemblies. Refer to the Scanner Troubleshooting section and Scan Converter Troubleshooting section for discussions of test dependencies and other possible causes.

Performance Problems

The following table lists common failure categories and the major system assembly likely to cause the fault. If one of the assemblies referenced below is suspected, refer to the corresponding section of this manual for additional troubleshooting information.

2-D Image Fault	Suspected Cause
Poor Image (contrast, detail, etc.)	Scanner Transducer Scan Converter Power Supplies Monitor contrast or brightness adjustment Change in room ambient light Operator controls misadjusted
Noisy or broken-up image; defect is only within the image area of the CRT display.	Scanner Scan Converter Power Supplies Noise on AC power lines
Noisy or broken-up image; defect extends beyond the image area of the CRT display.	Scan Converter Power Supplies CRT Display
Poor operation on one transducer only.	Scanner Transducer

Spectral Doppler Fault	Suspected Cause
Fixed frequency noise.	Scanner Power Supplies
Weak Doppler signal.	Transducer Scanner Scan Converter
Mirroring in the spectral display	Scanner Scan Converter Interconnect Cables

Color Doppler Fault	Suspected Cause
Poor sensitivity or fill-in	Transducer Scanner Scan Converter
Noise in color	Scanner Scan Converter Power supplies
Wrong color hue or intensity	Scan Converter Color Monitor
Poor color on recording devices only	Scan Converter Interface cables

System Switch Configurations

CED NTSC (17752) and CED PAL (17652)

These jumpers select between two possible formats for composite video: Y-C (used for Super-VHS recording format) and R-G-B (used for BetaCam recording format). Domestic systems ship with jumpers set for Y-C video; international systems ship with jumpers set for R-G-B.

Jumper	Y-C (S-VHS)	R-G-B
W1	1-2	2-3
W2	1-2	2-3
W5	1-2	2-3
W6	2-3	1-2

CMB

Jumpers are required only on NTSC-version assemblies that have the video RAM depopulated at locations U200, U205, U215, U220, U234, U239, U250, and U255.

Jumper	Comments
W1(5-6)	Installed for domestic (NTSC) version. Removed for international (PAL) version.

CSI 2

W16,W17,W18	Comments
1-2	Installed when connecting CSI 2 to DBR 2 or DBR 3 Rev. B and below.*
2-3	Installed when connecting CSI 2 to DBR 3 Rev. C and above.*

*Refer to DBR 3 for corresponding jumper settings.

CSI, SI 2, SI 1

Switch Bank A	Comments
SW 2	closed if IC 2 present
SW 3	closed if VC 1 Rev. B or higher present
SW 8	open (closed for factory testing only)

Keycap Annotation	SW5	SW6
Radiology, non-Doppler	closed	open
Radiology, Doppler	open	closed
Cardiology, Doppler	open	open

Second switch bank on CSI (SW B) is undefined.

CVC

Jumper	Color	B/W	Comments
W2	-	1-8	Color/B/W Status
W6	1-2	1-2	Composite Blank jumper
W7	-	1-2	Composite Sync jumper
W8	1-2	1-2	Red DAC output strapping
W9	1-2	2-3	VCR playback source
W10	-	1-2	Component Color jumper
W11	-	1-2	Component Video jumper
W12	see Comments		Determines RAM size. Set 1-2
W13	same as W12		if Rev. E or earlier. Set 2-3 if
W14	same as W12		Rev. F or later.

DAQ 1, DAQ 2 and DAQ 3

Board	W0	W1
DAQ 1	removed	installed
DAQ 2	installed	removed
DAQ 3	removed	removed

DBR 3

W1, W2	Comments
1-2	Installed when DBR 3 Rev. B and below connected to CSI 2* or DBR 3 any Rev to CSI 1.
2-3	Installed when DBR 3 Rev. C and above connected to CSI 2.*

*Refer to CSI 2 for corresponding jumper settings.

DBR 1, DBR 2 and DBR 3

SW 4 - open for 2 transducer ports.

Switch bank (S1) is undefined.

DCP 2

Jumper Number	Comments
W9	2-3 if system has an SCM 1-2 if system does not have an SCM

DSP 2

Jumper Number	Comments
W4(1-2)	Removed for DSP 2 ID
W5,W6,W7,W8,W9	Installed for DSP 2 ID

FEB 1 and FEB 2

Jumper Number	Comments
W1,W2	Installed for FEB 2 ID
W2	Installed for FEB 1 ID
W7	Installed for Spatial Persistence

FEC 2

Jumper Number	Comments
W1 (1-2,3-4,5-6)	Jumpers installed for FEC 2 ID

FPC 4

Switch Number	Comments
SW 1	Closed if Trackball present
SW 2	Closed if D-Gain Level knob present
SW 3	Undefined
SW 4	Closed if CD Level knob present
SW 5	Undefined
SW 6	Undefined
SW 7	Undefined
SW 8	Undefined

MEX 2

Each row of sockets must have jumpers selected for 128K, 256K, or 512K EPROM's

Jumper Number	Comments
BD1	Installed for 1st MEX in a system
BD2	Only used if 2nd MEX is installed
BD3	Only used if 3rd MEX is installed

OC 3

Jumper	Comments
W1	Removed
W2	Installed for NTSC video. Removed for PAL video
W3	Removed
W4	Installed
W5	Removed.
W6	Installed
W7	Installed
W8	Removed
W9-12(2-3)	(2-3) for 32K and 128K RAM device size, (1-2) for 256K and 512K
W13	Installed

U7 Switch Number	Comments
SW 1-2	Not used
SW 3	Off
SW 4-6	Undefined
SW 7-8	Not used

U152 Switch Number	Comments
SW 1	On-Scanner DPR tested by PONMON
SW 2-8	Undefined

PEM

Jumper	Comments
W1	Installed (A-B)
W2	Installed (A-B)

STG 4

Jumper Number	Comments
W1	Required only if STG 4 Rev. K.
W2	Required for 5 MHz Cardiac and 7 MHz transducers if STG 4 Rev. A to J.
W3	Required only if STG 4 Rev. L.
W4	Required to feed 'DOPCLK' to BBQ 3'S. Must be removed in systems without IGD or BBQ 3.

STG 3

Jumper Number	Comments
W1	Required to feed 'DOPCLK' to BBQ 3'S. Must be removed in systems without IGD.
W3	Required for 5 MHz Cardiac and 7 MHz transducers.

VDT 1 (17542 Rev C. or 18352 Rev. B) and VDT 2 (19982 or 20372)

P/N 19982 and 20372 identical except for jumpers.

P/N 17542 Rev. C and 18352 Rev. B identical except for jumpers.

The following jumpers affect the edge enhancement of the image which can be optimized for radiology or cardiology viewing. Jumpers are labelled differently on some revisions. Install jumpers as shown.

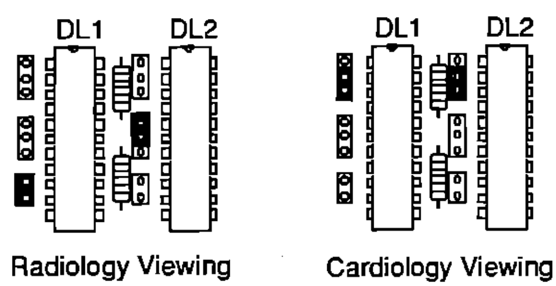

Figure 2-5. VDT Jumpers

XDY 3

Jumpers are set at the factory. Do not reposition any jumpers. Jumper positions may vary from board to board.

SECTION 3

Scanner

Scanner Architecture 3 2

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Scanner Assemblies 4 4

APD — Apodizer Board 45

AUX — Auxiliary Continuous Wave Doppler Board 47

BBQ — Baseband Quadrature Board 49

DBL — Distribution Board Left 51

DBR — Distribution Board Right 55

DCC — Dual Channel Controller Board 57

IGD — Interpolating Gain Driver Board 59

MEX — Memory Expansion Board 70

MXK — Mixer Clock Board 71

RCV — Receiver Board 74

SCP — Scanner Control Processor Board 82

SDL — Summing Delay Line Board 83

SGD — Scanner Gain Driver Board 89

SGI — Scanner Gain Interpolator Board 97

SMB — Scanner Motherboard 101

STG — Scanner Timing Generator Board 102

TDI — Transducer Interconnect Board 104

TRM — Terminator Board 108

VDT — Video Detector Board 109

XDY — Transmit Delay Board 111

XMT — Transmitter Board 113

Scanner Architecture

Scanner Operation

All Scanner operations are controlled by the Scanner Control Processor (SCP). A 10 MHz master clock is located on the Scanner Timing Generator (STG). Scanner operations are synchronized to this master clock signal.

The scanning sequence can be divided into three cycles:

- Scanner set-up
- Transmission
- Reception

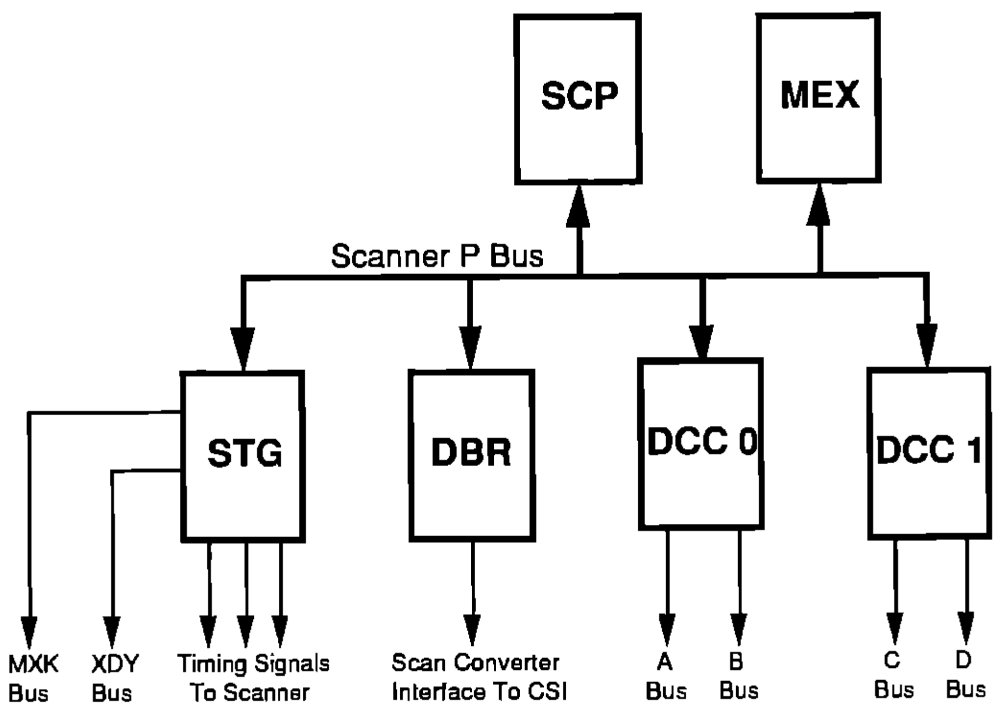


Figure 3-1. Scanner Control Block Diagram

Scanner Set-up Cycle

(see Figure 3-1)

During the Scanner set-up cycle, the following operations occur:

- Gain and control information from the front panel are passed from the Scan Converter to the Scanner.
- The type and number of the line to be fired is determined.
- The control data needed to configure the beamformers, beamformer drivers, and gain/video subsystems is output from the DCC boards via the A, B, C and D buses for the particular line being fired.

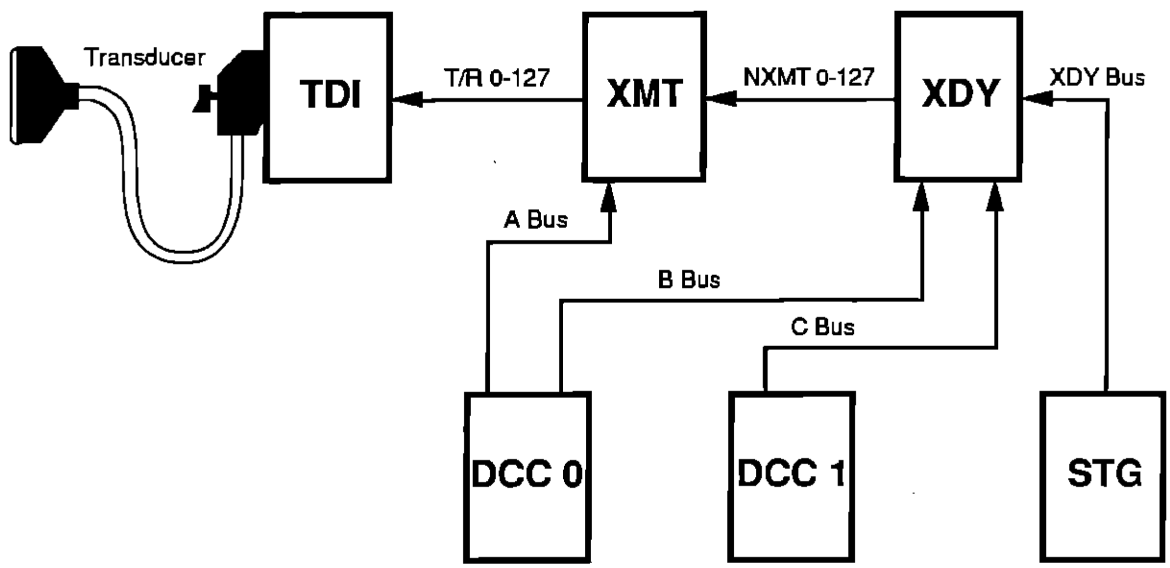


Figure 3-2. Scanner Transmit Block Diagram

Transmission Cycle

(see Figure 3-2)

After the set-up data has configured the Scanner for a particular ultrasound line, a signal from the SCP causes the transmit delay boards to output the phased transmit signals to the transmitter boards. The transmitter boards then output the high energy pulses required to drive the transducer elements to produce an ultrasound wave at the transducer face.

Reception Cycle

(see Figure 3-4)

After the transmit pulses are sent, echoes return to the transducer and are transformed into low level electrical signals. Signal flow through the Scanner during reception is as follows:

- Signals travel from the transducer elements through the transducer cable and enter the Scanner via the Transducer Interconnect board (TDI). The TDI carries the signals down to the motherboard, which carries them to the Receiver boards.
- The Receiver boards amplify the low level signals and convert them to an intermediate frequency using mixer signals from the Mixer Clock boards. Signals from the Apodizer boards and Interpolating Gain Driver board control the gain of the Receiver boards to compensate for depth loss and adjust the aperture of the array. Refer to Figure 3-3.
- The Receiver boards output the IF signal to the Summing Delay Line boards (SDL). The SDL boards properly sum the signals from the sixteen Receiver boards, and output the IF signal to the Distribution Board Left (DBL).
- The DBL sums the signals from the SDL boards into one signal called IF SUM. This signal is then sent to the Video Detector board for processing.
- The Video Detector board converts the received IF SUM signal to an ultrasound video signal. It also amplifies and performs special processing to the ultrasound video signal and outputs it to the DBL.
- The DBL buffers the ultrasound video signal and outputs it to the Scan Converter via connector J8.

Scanner Chassis

The Scanner consists of a card cage capable of containing up to 67 circuit boards plus the Scanner motherboard. It is located in the lower cart of the Acuson 128XP.

Transducers are plugged directly into the Scanner via the Transducer Interconnect board. Two connectors are provided, but only one port can be activated at a time.

Digital communication between the Scanner and Scan Converter is accomplished via a dual port RAM located on the Distribution Board Right (DBR). Analog signals are transferred to the Scan Converter via the Distribution Board Left (DBL).

Power is supplied to the Scanner from power supplies located in the power supply drawer and from a dedicated 5 VDC power supply located on the left side of the lower cart. Power connections are made via the DBL. In addition the +5V cables (4/0 wire) are connected directly to the Scanner motherboard. Voltages used in the Scanner are ±15 VDC, ±7.5 VDC, ±5 VDC and 150 VDC (programmable). See Power Supplies, section 5, for more detail. For Acuson 128/10 and 128/5 systems, refer to the appropriate earlier manual for power supply documentation.

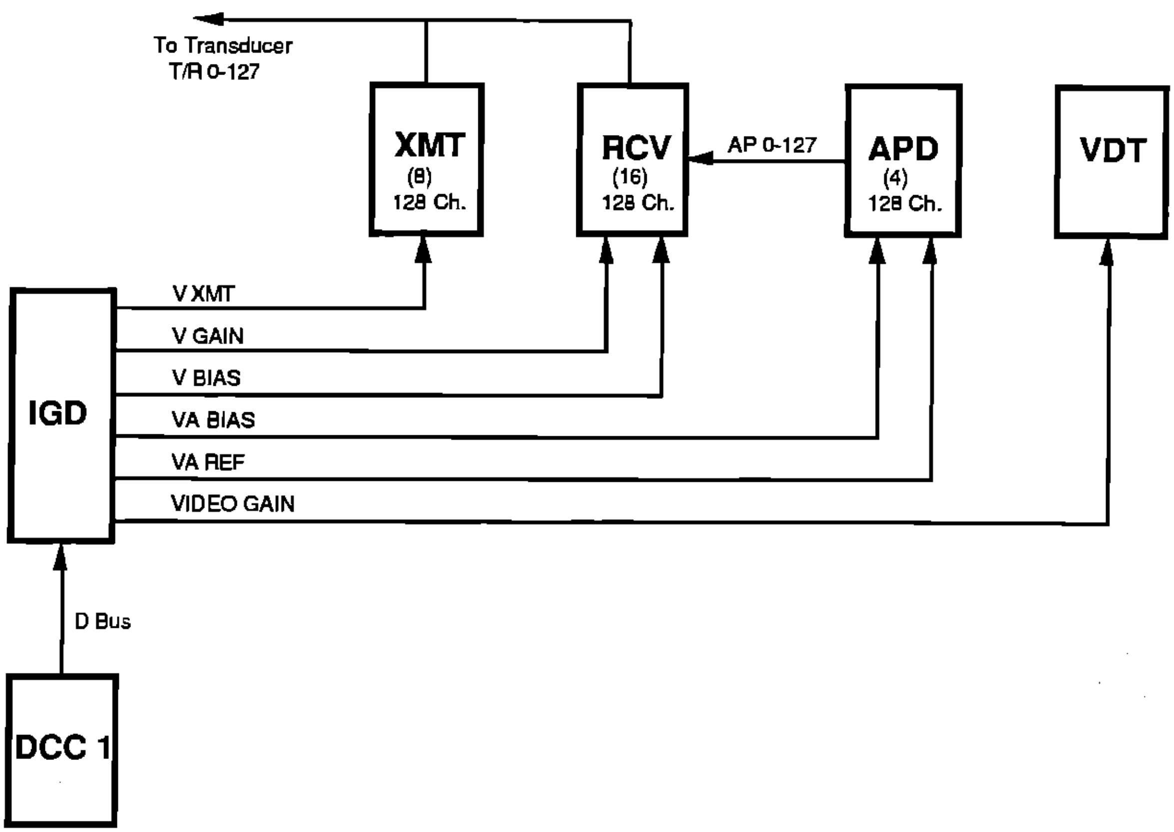


Figure 3-3. Scanner Gain Control Block Diagram

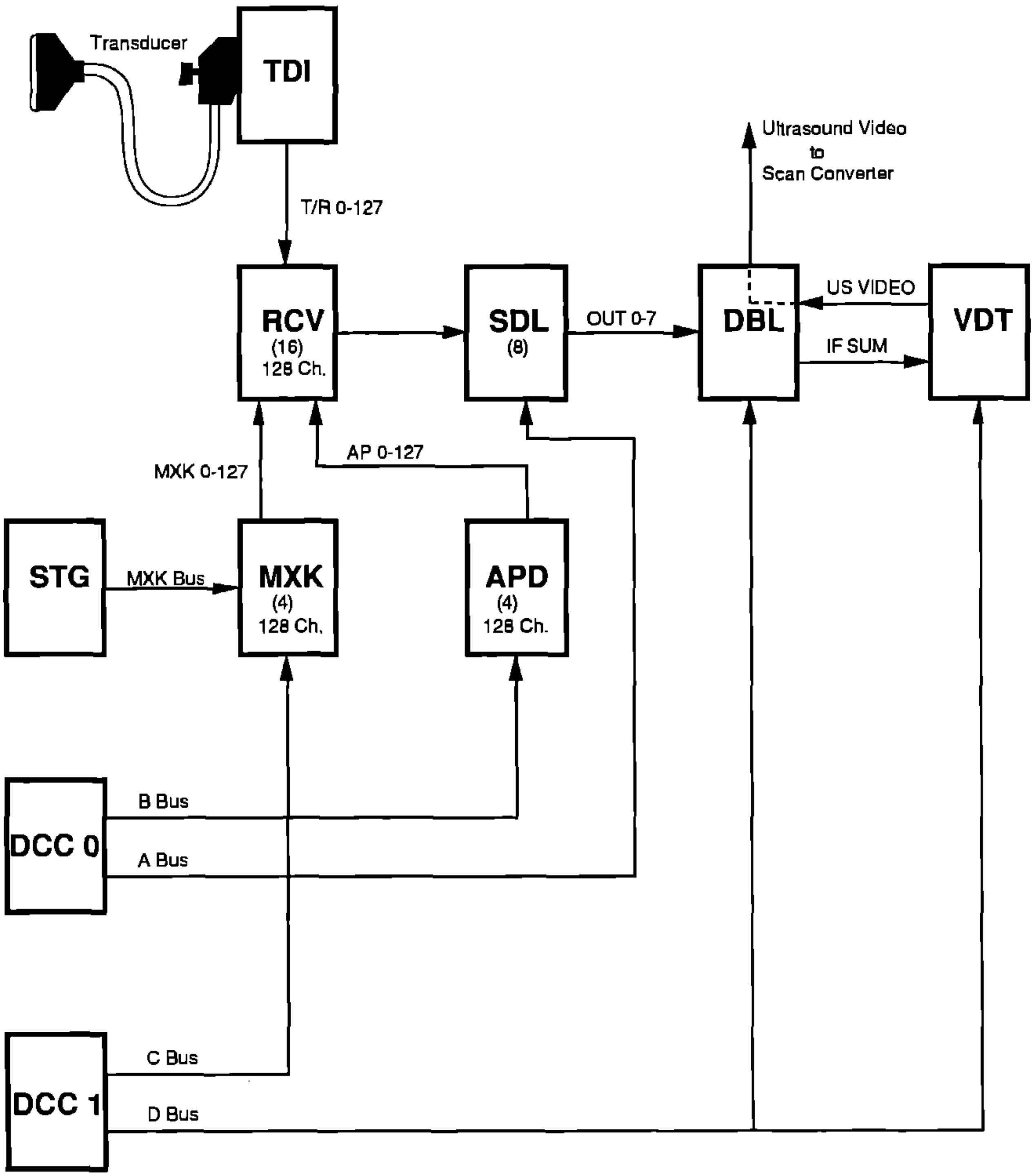


Figure 3-4. Scanner Receive Block Diagram

Scanner Subsystems

Scanner Motherboard

Used to interconnect all circuit boards in the Scanner. See Figure 3-5.

PCB Name	Abbreviation	Quantity	Ejector Tab Color
Scanner Mother board	SMB	1	N/A

Beamformer

The beamformer controls timing and amplitude of transmitted and received electrical signals from each of the 128 transducer elements. Using all 128 transducer elements in concert allows the formation of a coherent, focused beam.

PCB Name	Abbreviation	Quantity	Ejector Tab Color
Receiver	RCV	16	Black
Transmitter	XMT	8	Red
Summing Delay Line	SDL	8	Green

Beamformer Driver

The beamformer driver provides the control signals, clocks and gain controls to the beamformer.

PCB Name	Abbreviation	Quantity	Ejector Tab Color
Transmit Delay	XDY	8	White
Apodizer	APD	4	Yellow
Mixer Clock	MXK	4	Black

Digital Processing/Control

This section contains the digital circuitry needed to control the Scanner and interface with the Scan Converter.

PCB Name	Abbreviation	Quantity	Ejector Tab Color
Scanner Control Processor	SCP	1	Red
Dual Channel Controller	DCC	2	Red
Scanner Timing Generator	STG	1	Red
Memory Expansion	MEX	1-3	Red
Distribution Board Right	DBR	1	Black
Terminator	TRM	1	Red

Gain/Video Processing

This section is used to set the gain levels in the Scanner. The gain curve is determined by the microcode for each transducer and the settings of the master gain control and the DGC pots. Note that the IGD circuit board, if installed, replaces both the SGI and SGD circuit boards. Also included here is the VDT which performs log compression and filtering operations.

PCB Name	Abbreviation	Quantity	Ejector Tab Color
Scan Gain Interpolator	SGI	1	Green
Scan Gain Driver	SGD	1	Green
Interpolator/Gain Driver	IGD	1	Green
Video Detector	VDT	1	Green

Doppler Processing

These boards are used to provide the preliminary processing of Doppler signals. The BBQ is required in all Doppler systems. The AUX board is required only in systems with imaging or auxiliary CW Doppler.

PCB Name	Abbreviation	Quantity	Ejector Tab Color
Baseband Quadrature	BBQ	1	Green
Auxiliary CW	AUX	1	Green

Interconnect I/O

These boards handle all interfacing between the Scanner and other parts of the system including power supplies, the transducer and the Scan Converter.

PCB Name	Abbreviation	Quantity	Ejector Tab Color
Transducer Interconnect	TDI	1	Black
Distribution Board Left	DBL	1	Black
Distribution Board Right	DBR	1	Black

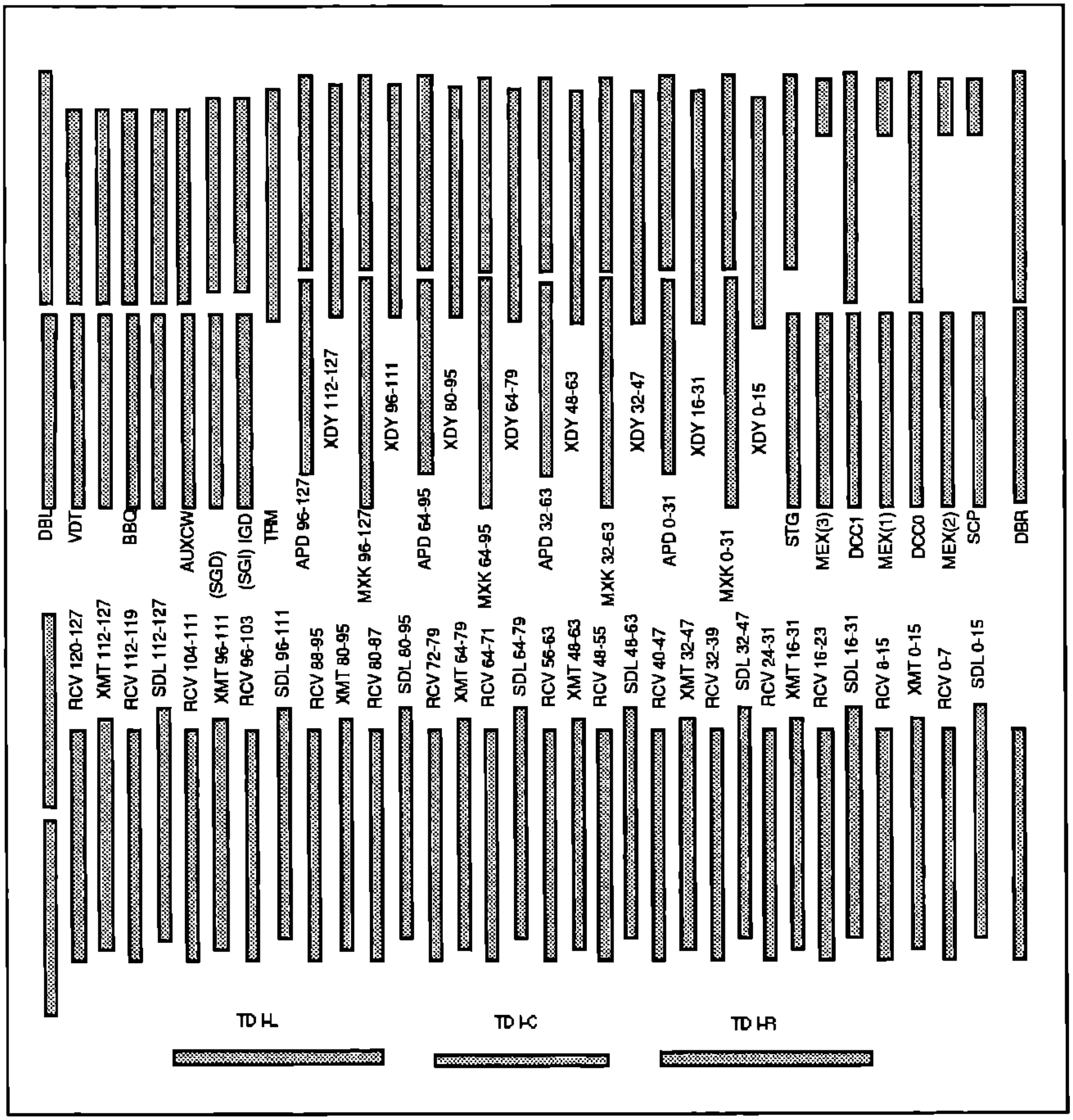


Figure 3-5. Scanner Motherboard Layout

Scanner Troubleshooting

Failures of Scanner boards can result in power-up errors or incorrect system operation. The following is a general overview of Scanner troubleshooting. For greater detail, turn to the section for the specific board.

Although unlikely, failures of the Scanner Mother Board may cause a wide variety of symptoms. If changing other Scanner boards does not correct a failure, the SMB should be changed as a last resort.

Power-up Errors

Scanner power-on diagnostics tests the Scanner digital circuitry when the system is powered on or reset. If a fault is detected, one of the following error messages is displayed on the monitor.

Error Message	Meaning
S.INTRPT Power-up Error	Error in the Scanner interrupt circuitry. Check SCP, STG, DCC, DBR, CSI (SI), MEX and chassis interconnect cables
DPR Power-up Error	Error in dual port ram (on DBR) Check DBR, SCP,and CSI (SI) and interconnecting cables.
SCP Power-up Error	Check SCP.
DCC Power-up Error	Check DCC and SCP.
MEMEX Power-up Error	Check MEX and SCP.
Power Supply Failure	PPS did not respond to programming commands. Check PPS and DBR and interconnecting cables.
Scanner and Microcode Incompatible	SCP unable to read code on MEX. Check MEX.

Scanner Timing Generator Problem	STG cannot synthesize requested frequency. Check STG version and jumpers.
Obsolete DCC Boards	Scanner firmware detected DCC 1 boards present.
Scanner Orphan Prom Not Present	SCP unable to read MEX boards correctly. Check SCP and SCP PROM on MEX.

Operational Problems

When troubleshooting Scanner operational problems, it is valuable to think of the Scanner in three sections.

- Channel Circuitry
- Analog Processing
- Digital Control

This will allow you to focus your troubleshooting efforts on a reduced set of boards and similar techniques may be used on each class of circuit board.

Channel circuitry

RCV	SDL	XMT	APD
MXK	XDY	TDI	DBL

This group includes the beamformer and beamformer driver boards. Failures of these boards frequently result in defects localized at a specific channel or channels. Typically these defects are most obvious with linear transducers. The problem is obvious close to the transducer and becomes less distinct as you move deeper. To troubleshoot problems of this type, try swapping the boards associated with the problem channels to another location. When the defect moves, you have identified the defective assembly.

WARNING!! Do not remove or install a PCB with the power on.

When the defect is not localized to specific channels, an effective technique is to replace the suspected boards one at a time until the problem is eliminated.

Analog processing

VDT	IGD (SGI, SGD)	BBQ	AUX

These boards process the combined ultrasound signal from all channels. The IGD is included in this group because it controls gain functions that influence all channels.

Failures of boards in this group result in loss of gain or resolving power across all channels. Failures of the VDT affect only 2-D imaging; Doppler performance is unaffected. Failure of the BBQ will affect all Doppler modes, but not 2-D imaging. Failure of the AUX will affect only CW and AUX CW operation. The IGD can cause problems in all operating modes.

Digital control

SCP	STG	DCC	MEX
TRM	DBR		

These boards control the functions of the Scanner and coordinate its operation with the Scan Converter. Failures can affect all aspects of Scanner operation. The following table lists some typical failure types and the digital control boards to check.

Symptom	Check
System lockup; frame rate goes to zero Hz	SCP, STG, DCC, MEX, DBR, TRM
Noise (2-D and Doppler)	STG, DCC, SCP
beamformer malfunction	STG, DCC, SCP
Malfunction of a single transducer	MEX

Scanner Assemblies

The following pages describe each board used in the Scanner. A functional description of each board is provided as well as troubleshooting and replacement information. Information regarding revision markings and how they are interpreted may be found in Section 1.

APD — Apodizer Board

P/N:	10332T
Ejector Tab Color:	Yellow
Quantity:	4
Power Supplies:	+7.5V, +15V, -15V, +5V
Buses:	B
Signals In:	N/A
Signals Out:	AP00 - AP31

Revision Requirements

APD Rev. 2 ok for all systems.

Function

The Scanner has four Apodizer boards, each with 32 Apodizer channels, providing a total of 128 Apodizer channels. The function of the Apodizer channels is to adjust the aperture of the transducer array. The output of an Apodizer channel drives the apodizing amplifier section of an associated Receiver channel. The output of each Apodizer channel is carried to each Receiver channel via lines AP00-AP31.

The Apodizer boards are controlled by microcode on DCC 0 via the B bus. Logic on the Apodizer board buffers and latches control words from the B bus to configure the Apodizer board for a particular ultrasound line. Addresses for the Apodizer boards are encoded into the motherboard connectors to identify each of the four Apodizer boards in the Scanner.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Visual Symptoms

It is usually difficult to determine, using only visual clues, that an imaging problem is due to an Apodizer board. When an Apodizer channel fails, the associated receiver channel floats to almost full gain, and the only effect on the image is a slight aperture non-conformance. Subtle distortions may be present in the image when an entire Apodizer board has failed. The best way to determine a fault in an Apodizer channel is to swap the Apodizer boards one at a time and inspect the image.

Measurable Symptoms

If a faulty Apodizer board is suspected, measure all four Apodizer boards with an oscilloscope:

- TP0 - Common
- TP1 - VA REF - A steady +5.2 VDC level (may be slight ripple, 0.1 V)
- TP2 - VA BIAS - A steady -1.7 VDC level

If one board has measured values other than those stated, the on-board buffers may have failed and the board should be replaced. If all four boards measure incorrectly, the fault may lie in the IGD (or SGD) board.

AUX — Auxiliary Continuous Wave Doppler Board

P/N:	17332T
Ejector Tab Color:	Green
Quantity:	1
Power Supplies:	+15V, -15V, +5V
Buses:	D
Signals In:	Aux RCV when using the aux transducer IF FIL when using array CW
Signals Out:	AUX XMT when using the aux transducer AUX CARR

Revision Requirements

AUX Rev. D required for CW Doppler.

AUX Rev. A required for 2MHz AUX CW.

AUX Rev. H required for CW Doppler on the S7146 transducer.

Function

The AUX board operates in one of two modes depending upon the type of CW function being used.

In the first mode, an auxiliary continuous wave transducer is used. This transducer has a single piezo-electric transducer element for transmitting and a second element for receiving. In this mode the AUX board generates the transmit pulses which drive the transducer. These pulses are passed to the transducer via the DBL BNC connector AUX XMT. The receive signal enters the Scanner via the DBL BNC connector AUX RCV. The AUX board then filters out the Doppler component of the return signal and outputs the AUX CARR signal to the BBQ board.

In the second mode, an Acuson 128-element imaging transducer is used. A number of the transducer elements are continuously transmitting while others are continuously receiving. Actually, the process is more or less continuous since it is possible to update the 2-D image periodically. The format for transmit and receive is configured by the Scanner and the signal processing is similar to normal Doppler operation with the following exception: the IF FIL signal from the VDT is passed to the AUX board for processing rather than being processed by the BBQ directly. After the AUX board has separated the Doppler signal it passes the AUX CARR to the BBQ. Once at the BBQ , the signal is processed in the usual manner.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

The processing of CW Doppler data shares substantial circuitry with the Pulsed Doppler mode. Therefore, the first step in troubleshooting a problem is to determine whether the problem appears in both Doppler modes.

No Signal

If no CW signal appears on the Doppler strip, check Pulsed Doppler.

If a signal is obtained in Pulsed Doppler, then the problem is likely to be the AUX board, the DBL board, the cables from the DBL to the Aux CW transducer connector, or the transducer. If no signal is present in Pulsed Doppler, then the problem is most likely to be the BBQ, the DAQ or the DSP board.

Sidebanding

Sidebanding appears as a horizontal line in the Doppler strip and as a continuous audio tone. If the sidebanding appears only in CW Doppler, the problem is most likely to be the AUX circuit board. Replace the board. If it also appears in Pulsed Doppler, the problem could be an oscillation of one of the power supplies or noise on the AC power line or improper grounding of the Scanner chassis (see the Power Supply Troubleshooting section for more information). The problem may also be with the BBQ, DAQ or DSP board.

Mirroring

Mirroring appears as a phantom signal on the Doppler strip. It will be the same velocity but in the opposite direction to the true signal. If the mirroring appears only in CW Doppler, the problem is most likely to be the AUX circuit board. Replace the board. If it appears in Pulsed Doppler also, the problem could be the BBQ, DAQ or DSP board. A loss of the in-phase (I) or quadrature (Q) signal in the Scanner analog cable (DBL J8) can also cause mirroring.

BBQ — Baseband Quadrature Board

P/N:	BBQ 1	13992T
	BBQ 2	17122T
	BBQ 3	18522T
Ejector Tab Color:	Green	
Quantity:	1	
Power Supplies:	+15V, -15V, +5V	
Buses:	D	
Signals In:	IF FIL, AUX CARR when using CW Doppler	
Signals Out:	I,Q	

Revision Requirements

BBQ 3 Rev. B required for CW Doppler.

BBQ 2 Rev. A ok for all others.

BBQ 1 Rev. 4 ok for all others.

Function

The BBQ is active only when in Doppler modes. It converts the IF FIL signal from the VDT to an "I" signal (in phase) and a "Q" signal (quadrature). The I and Q signals preserve amplitude, frequency and phase information for subsequent processing by the DAQ and DSP. When using continuous wave Doppler, the AUX CARR signal is processed rather than the IF FIL signal.

The BBQ 1 and BBQ 2 have local oscillators to generate the frequencies used for processing of the signal. The BBQ 3 uses a clock taken from the STG. For this reason an STG 3 or STG 4 and an IGD is required when using a BBQ 3.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

The BBQ is used to generate the I and Q signals used in processing all Doppler data. Therefore, any significant problems with the BBQ will generally show themselves in Pulsed Doppler, color Doppler and CW Doppler.

Note that noise affects each modality to a different degree. This is due to the nature of the measurement.

- CW Doppler — Most sensitive
- Pulsed Doppler — Moderately sensitive
- Color Doppler — Least sensitive

Problems caused by the BBQ include sidebanding, mirroring, weak Doppler signal or no Doppler signal. If any of these symptoms are present replace the BBQ.

No Signal

If no signal is present in Pulsed Doppler, then the problem is most likely to be the BBQ, the DAQ or the DSP board.

Sidebanding

Sidebanding appears as a horizontal line in the Doppler strip and as a continuous audio tone. If the sidebanding appears in Pulsed Doppler, the problem could be an oscillation of one of the power supplies or noise on the AC power line or improper grounding of the Scanner chassis (see the Power Supply Troubleshooting section for more information). The problem may also be with the BBQ, DAQ or DSP board.

Mirroring

Mirroring appears as a phantom signal on the Doppler strip. It will be the same velocity but in the opposite direction to the true signal. If the mirroring appears, the problem could be the BBQ, DAQ or DSP board. A loss of the in-phase (I) or quadrature (Q) in the Scanner analog cable (DBL J8) can also cause mirroring.

DBL — Distribution Board Left

P/N:	DBL 1 10392T
Ejector Tab Color:	Black
Quantity:	1
Power Supplies:	+15, -15, +7.5, -7.5, +5, +150, -5V produces on DBL from the -7.5V supply
Buses:	D
Signals In:	See below.
Signals Out:	See below.

Revision Requirements

DBL Rev. 6 required for transducers with internal thermal sensing and AUX CW.

DBL Rev. A required for CW Doppler.

DBL Rev. 4 ok for all others.

Function

The DBL performs the following functions:

- Signal routing of the SDL outputs
- Terminating the A and D bus
- Buffering the test point outputs and analog outputs
- Carrying DC power from power cables to Motherboard
- Carrying probe temperature information from FPC to Scanner

The DBL buffers and provides a BNC output jack for the following signals:

J9	IF FIL
J10	IF SUM
J11	REF CLK+/
J12	SOF/
J13	AUX RCV
J14	AUX XMT
J15	VSOT/
J16	SOL/
J17	M-MODE
J18	US VIDEO
J19	B ENAB (input)
J20	PERCLK/

The DBL also outputs the following signals to the Scan Converter via J8:

US VID+	18
US VID -	5
M MODE +	24
M MODE -	11
I+	21
I-	8
Q+	15
Q-	2

DC Power Connectors

DC power from the linear power supplies enters the DBL from the following connectors:

SUPPLY	CONNECTOR	PIN NO.	TEST POINT
-7.5V	J5	1	TP6
	J7	9	
+7.5V	J5	3	TP7
	J7	6	
-15V	J5	7	TP10
	J7	1	
+15V	J5	9	TP9
	J7	2	
+5V	J6	1-6	TP8
+150V	J7	15	TP5
-5V			TP3

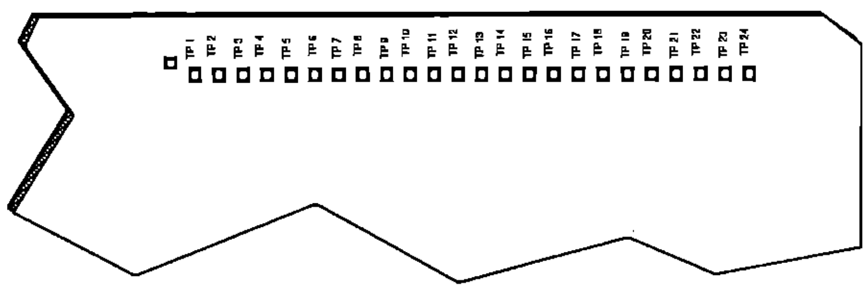


Figure 3-6. DBL Test Points

The DBL is controlled by microcode on DCC 1 via the D bus. Logic on the DBL buffers and latches control words from the D bus to configure the DBL for a particular ultrasound line.

The DBL board has 12 BNC-type connectors, one D-type connector and three Molex connectors on the outside of the board. To remove the DBL board from the Scanner disconnect cables J5, J6, J7 and J8 and remove the left side card cage panel.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Replacing the DBL requires the disconnecting J5, J6, J7 and J8. In addition, the left side of the card cage must be removed.

The symptoms of a faulty DBL include bar dropouts, similar to that of a faulty SDL board (See Figure 3-23) or no image. If troubleshooting the SDL boards seems to have no effect on the problem, the next step is to swap the DBL board.

Also, the power supply voltages are affected by failures of the connectors on the DBL. If voltages are not evident on the test points listed above, but the power supplies are active, check the connectors for damaged pins.

DBR — Distribution Board Right

P/N:	DBR 1	10402T
	DBR 2	13582T
	DBR 3	22192T
Ejector Tab Color:	Black	
Quantity:	1	
Power Supplies:	+15V, +5V	
Buses:	A, P	
Signals In:	See below.	
Signals Out:	See below.	

Revision Requirements

DBR 1 Rev. 8 required for pulsed Doppler or color Doppler.

DBR 1 Rev. 5 ok for all others.

DBR 2 required in systems with a PPS.

DBR 2 Rev. A required for CW Doppler.

DBR 2 Rev. 5 required for pulsed Doppler and color Doppler.

DBR 2 Rev. 2 ok for all others.

DBR 2 Rev. J or DBR 3 required for TDI 3 and Transducer Switch.*

DBR 3 Rev. XA ok for all systems.*

*Refer to System Switch Configurations in Section 2 for proper jumper settings.

Function

The Distribution Board Right is located along the right side of the Scanner card cage. It has one four-pin molex connector, one 15-pin molex connector and three D-type connectors on the outside of the board. The Distribution Board Right cannot be removed from the Scanner without first disconnecting cables J4, J5, J6, J7 and J8 and removing the right side card cage panel.

The DBR performs the following functions:

- Forms data and communication link between the Scanner and Scan Converter
- Carries the A bus from the rear to the front of the Scanner
- Terminates the P bus

Dual Port RAM

The DBR provides a data link between the Scanner and the Scan Converter by means of a dual port RAM. An arbitration system allows the microprocessors located on the SCP and Output Controller to access the dual port RAM one at a time and thus pass control data and information asynchronously.

The three D-type connectors on the DBR carry the following:

- J4 Control lines - to Scan Converter
- J5 Interface address lines - to Scan Converter
- J6 Interface data lines - to Scan Converter

The four-pin molex connector provides the +5V sense signal to the +5V switching power supply.

The 15-pin molex connector provides interconnect for the data lines used by the programmable power supply.

Troubleshooting

The dual port RAM is checked when the system is turned on or reset. If a failure occurs the system will display the following:

DPR POWER UP ERROR

See the Scanner Troubleshooting section.

DCC — Dual Channel Controller Board

P/N:	DCC 2 13502T
	DCC 3 21552T
Ejector Tab Color:	Red
Quantity:	2
Power Supplies:	+5V
Buses:	P
	DCC slot 0; A, B bus.
	DCC slot 1; C, D bus
Signals In:	SYSRST, 5 MHz(STG),
Signals Out:	N/A

Revision Requirements

DCC 3 required for Vector Array and curved array.

DCC 3 Rev. B ok for all systems.

DCC 3 requires SCP 2 Rev. B or higher or SCP 3 Rev. H or higher.

DCC 2 Rev. 7 ok for all systems.

DCC 1 no longer supported.

Function

The purpose of the DCC is to provide high speed data transfer to control the functions of the Scanner. The DCC is basically a high speed memory board that drives two digital buses: an 8-bit data bus, and a 16-bit data bus. Both buses have an 8-bit address bus. Two DCC boards are used in the Scanner. The DCC nearest the right side of the Scanner, DCC-0, drives the A and B buses. The other, DCC-1, drives the C and D buses. The A, B, C, and D buses carry control information to the beamformer, beamformer drive and video gain processing sections of the Scanner.

During the scanning cycles, the DCC's output the necessary control information onto the A, B, C, and D buses.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Parts of the DCC's are verified when the system is turned on or reset. If a failure is detected, it will be displayed on the monitor as:

DCC (0,1) POWER UP ERROR

DCC-0 and DCC-1 are completely interchangeable. Therefore, if a problem is suspected, DCC-0 and DCC-1 may be swapped. Verify that the nature of the problem changes.

See the Scanner Troubleshooting section.

IGD — Interpolating Gain Driver Board

P/N:	IGD 1	18062T
	IGD 2	21012T
Ejector Tab Color:	Green	
Quantity:	1	
Power Supplies:	+15V, -15V, +5V	
Buses:	D	
Signals In:	Control words from D bus.	
Signals Out:	VBIAS, VGAIN, VA BIAS, Video Gain, VXMT Bias	

Revision Requirements

IGD 2 required for transducers with internal thermal sensing.

IGD 2 Rev. XA ok for all systems.

IGD 1 Rev. A required for color Doppler, CW Doppler or if a BBQ 3 is used in the system.

Function

Replaces SGI and SGD circuit boards.

The IGD board is required in CW Doppler and color Doppler systems or when using a BBQ 3. The IGD board is compatible with non-CW Doppler and B/W systems, where it is used in lieu of the SGI and SGD.

The IGD performs a high speed interpolation of the control words sent on the D bus. The control words configure the IGD for a particular gain format. Five A/D convertors provide the following gain signals for use by the Scanner:

- Receiver Gain
- Receiver Bias
- Transmit Power
- Video Gain
- Apodizer Bias

The Apodizer reference level is also generated on the IGD board.

The IGD 2 has comparator circuitry which monitors the thermal sense line and provides a fail-safe shut down of XMT boards.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Figures 3-8 through 3-12 illustrate the image when the individual channels of the IGD have failed.

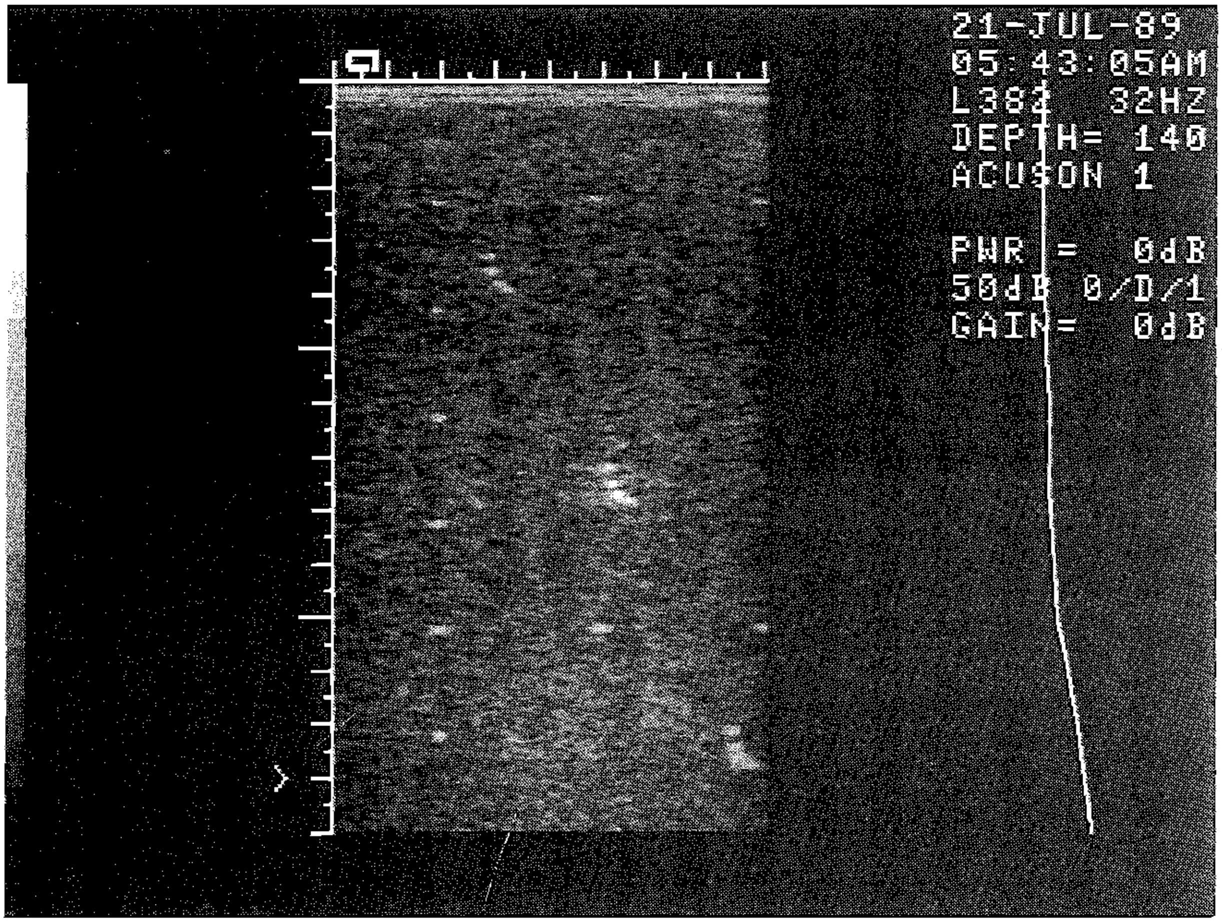
If you suspect a problem on an IGD board, swap the board and retest.

An IGD 2 failure may cause the XMT boards to shut down without any error messages associated with thermal sensing transducers.

The following table lists the test points available on the IGD:

Test Point	Signal	Comments
TP0	Common Terminal	
TP1	V BIAS	
TP2	VA BIAS	stable -1.6VDC ±.15V
TP3	V GAIN	
TP4	VIDEO GAIN	
TP5	VT- on-board DAC compensation	approximately 10.3VDC
TP6	VA REF	1/2 of TP5 ±.15V
TP7	not used	
TP8	not used	
TP9	VXMT BIAS	
TP10	VR -DAC reference voltage	10VDC ±.1V

Gain values vary depending on the scan format in use. The images following provide guidelines for determining failures of the IGD.



This is a normal image with the same control settings as Figure 3-12.

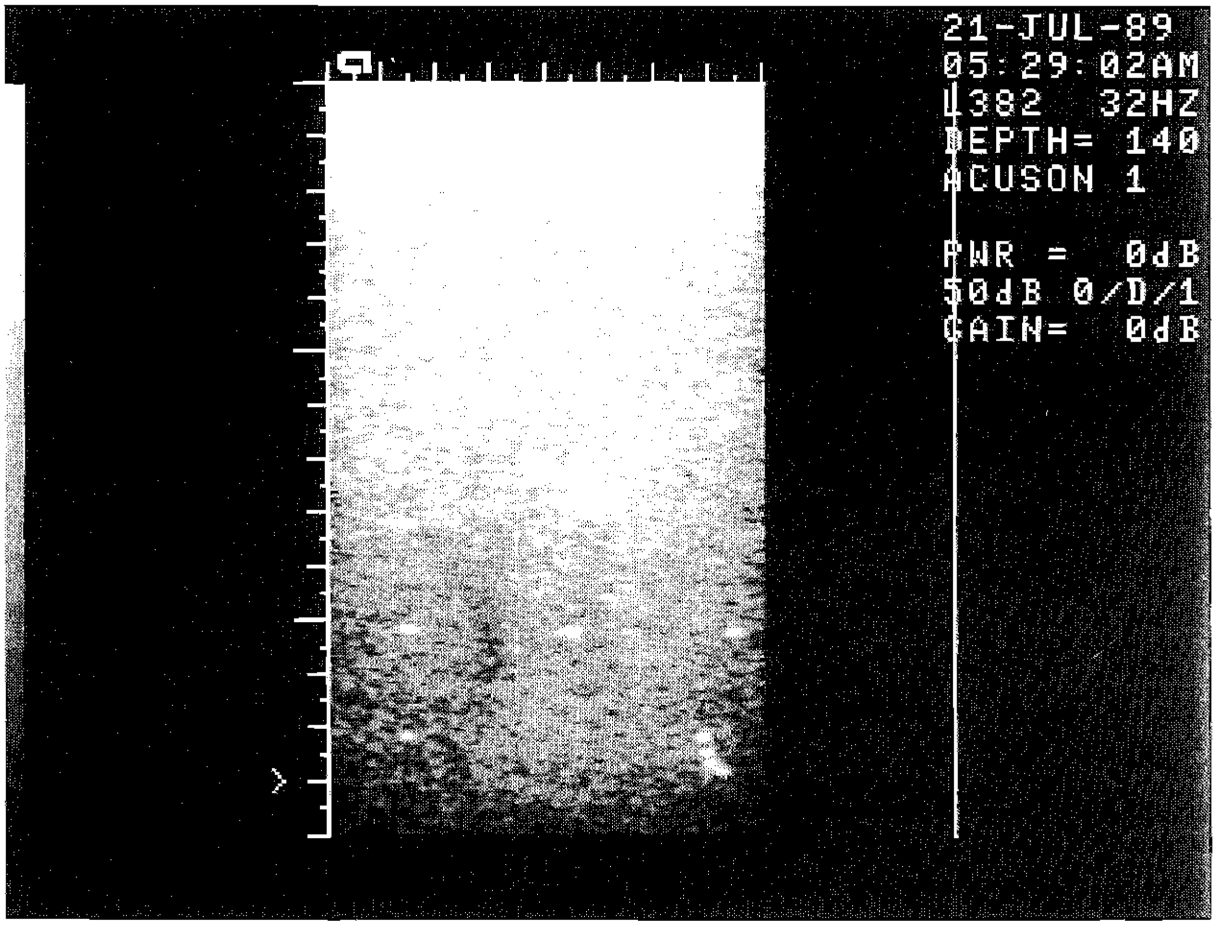


Figure 3-8. Interpolating Gain Driver — No VGAIN Output

Note that the DGC controls are set to minimum, yet the gain level seems almost saturated. Gain control adjustments have minimal effect on the image.

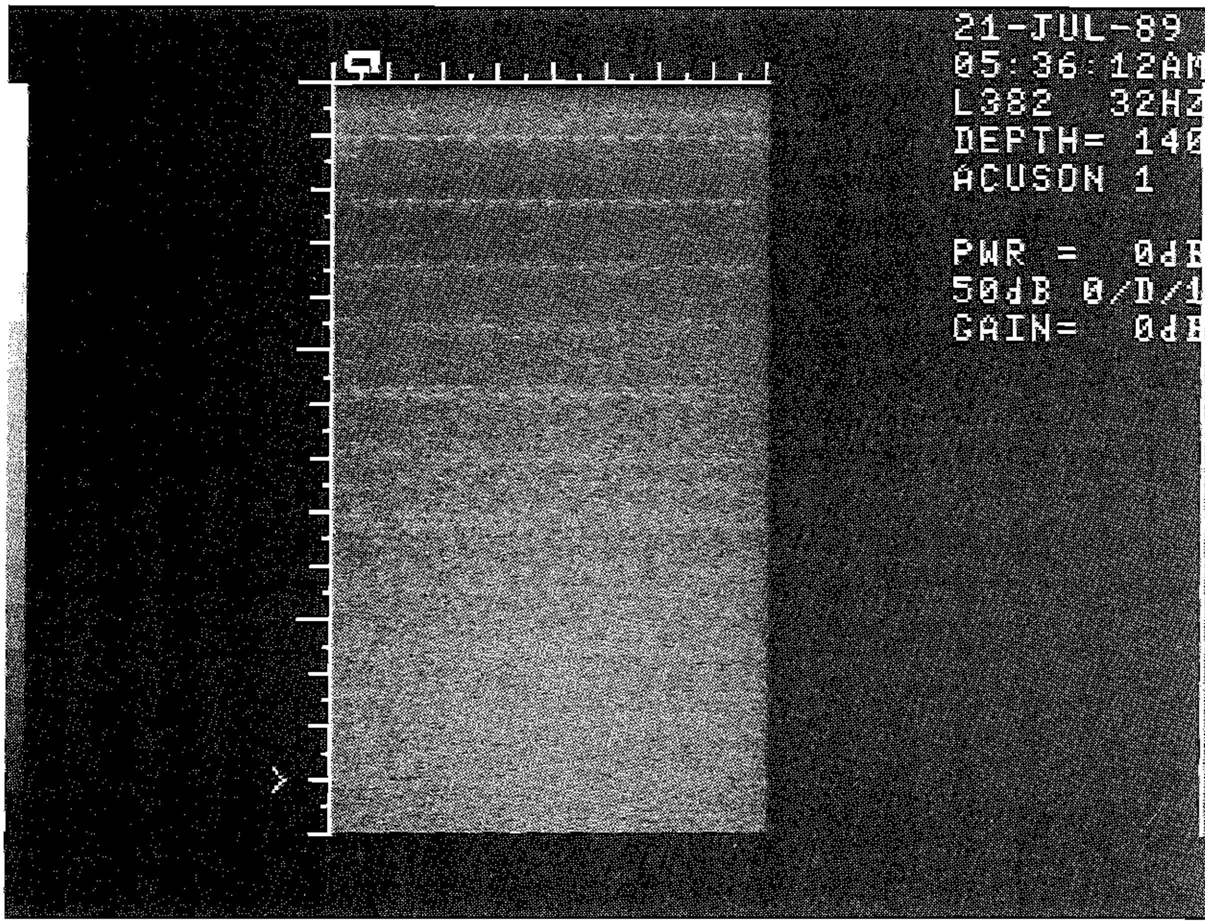


Figure 3-9. Interpolating Gain Driver — No VBIAS Output

Note that the DGC controls are at maximum and the ringdown and mixer clock noise is visible in the image, yet the image of the phantom is faint or not visible.

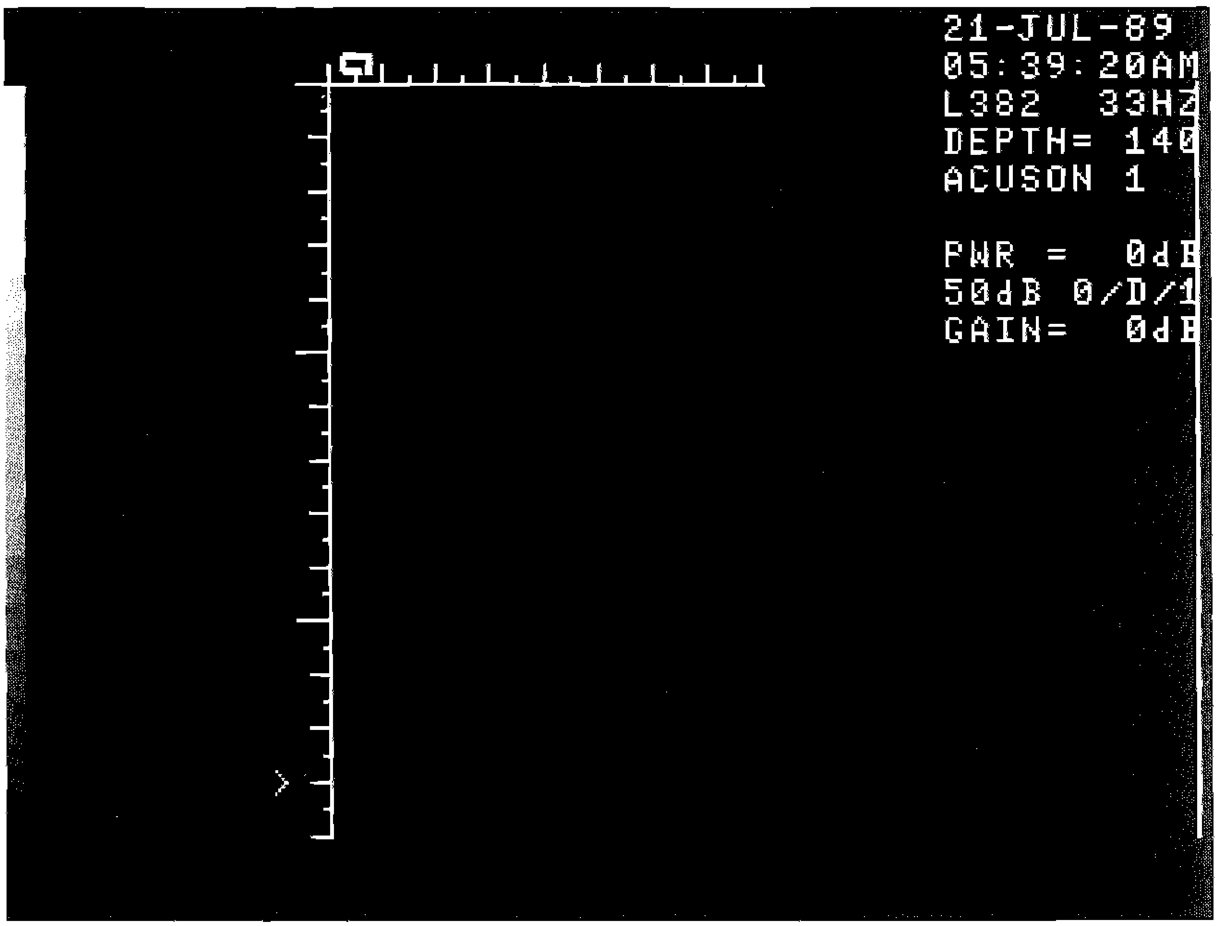


Figure 3-10. Interpolating Gain Driver — No VXMT BIAS Output

With no VXMT BIAS signal, there is no transmit signal. Note the lack of transmit ringdown in the image. This symptom is very similar to a loss of the 150V power supply.

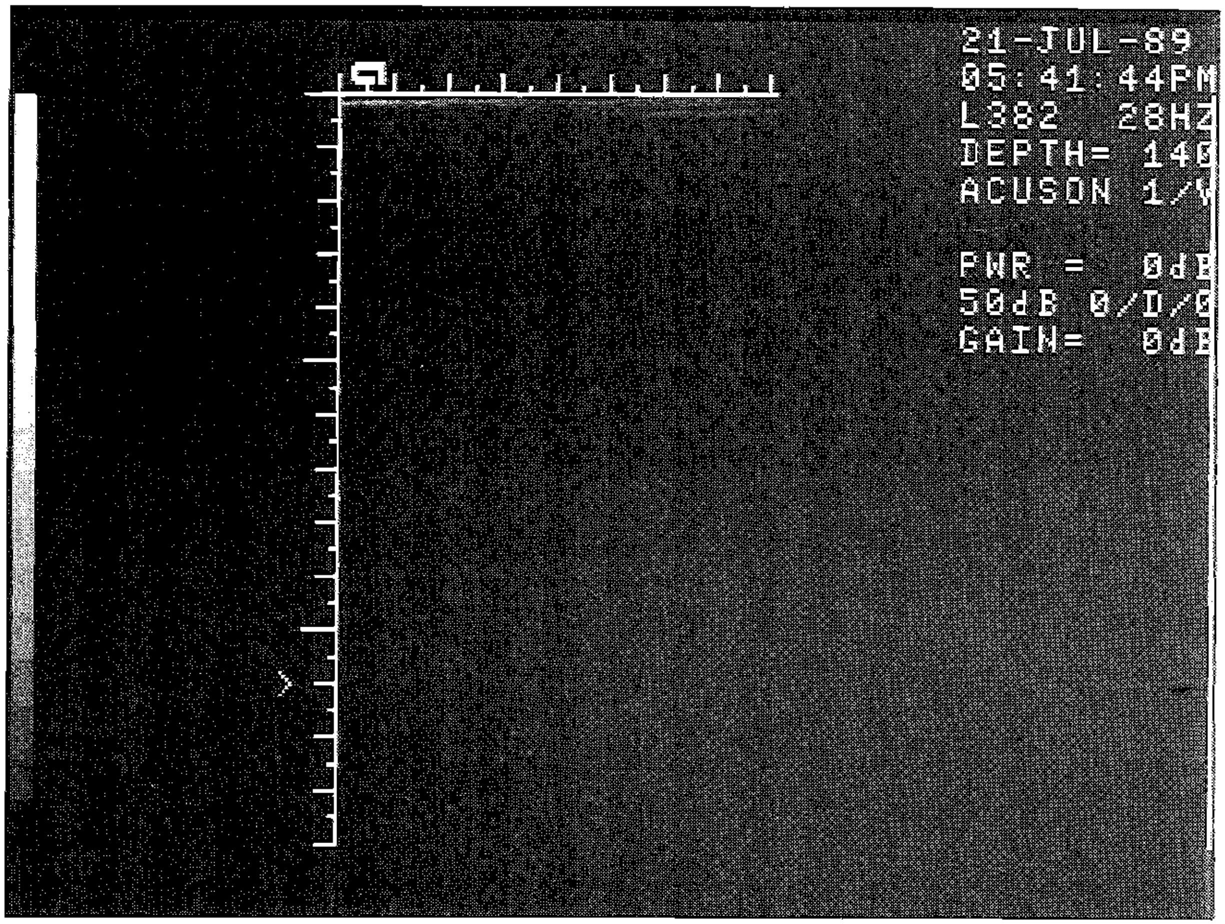


Figure 3-11. Interpolating Gain Driver — No VIDEO GAIN Output

With no VIDEO GAIN signal, the image is entirely black. This symptom is similar to a dead 15 V or 7.5 V power supply.

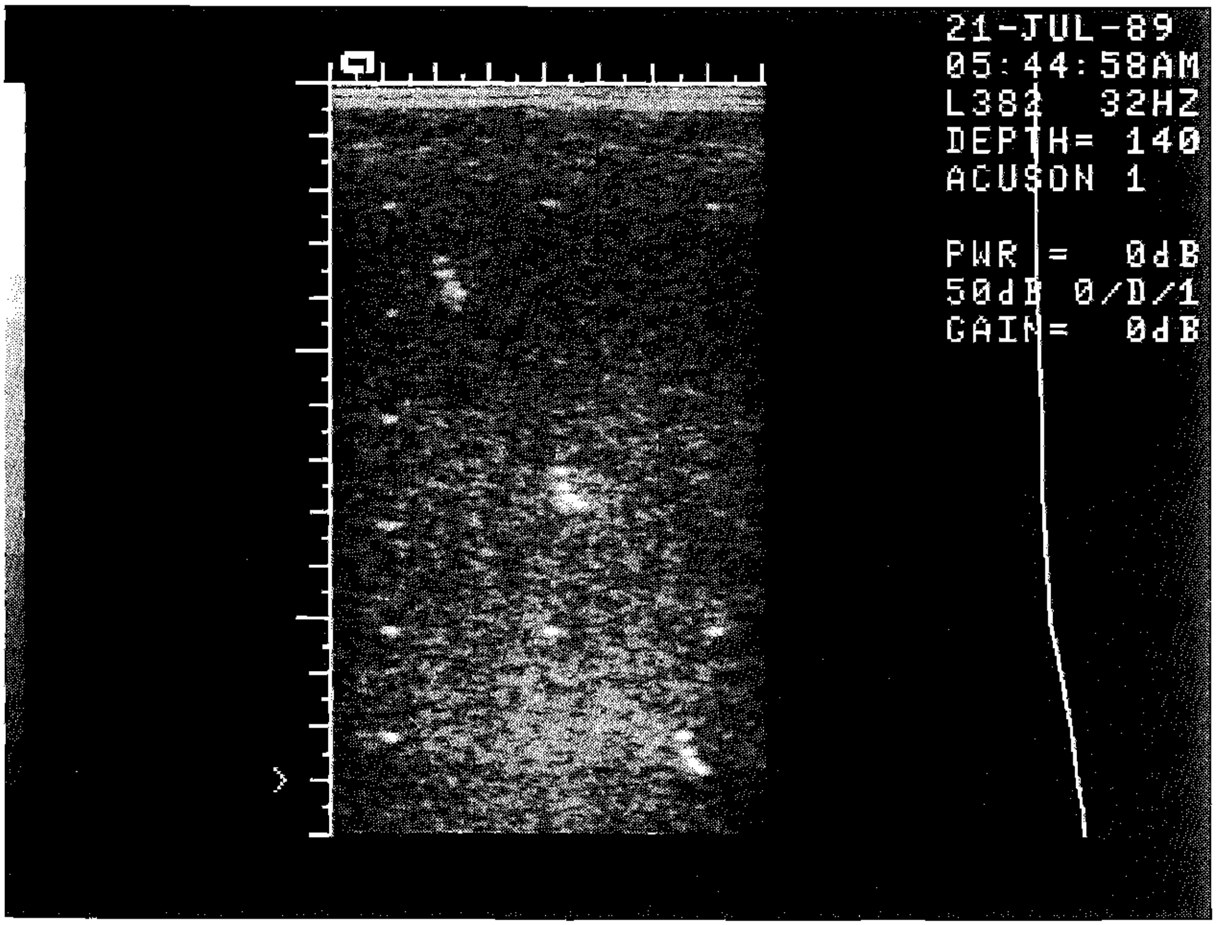


Figure 3-12. Interpolating Gain Driver — No VA BIAS Output

This image has no VA BIAS output. Note the uneven gain and smeared targets.

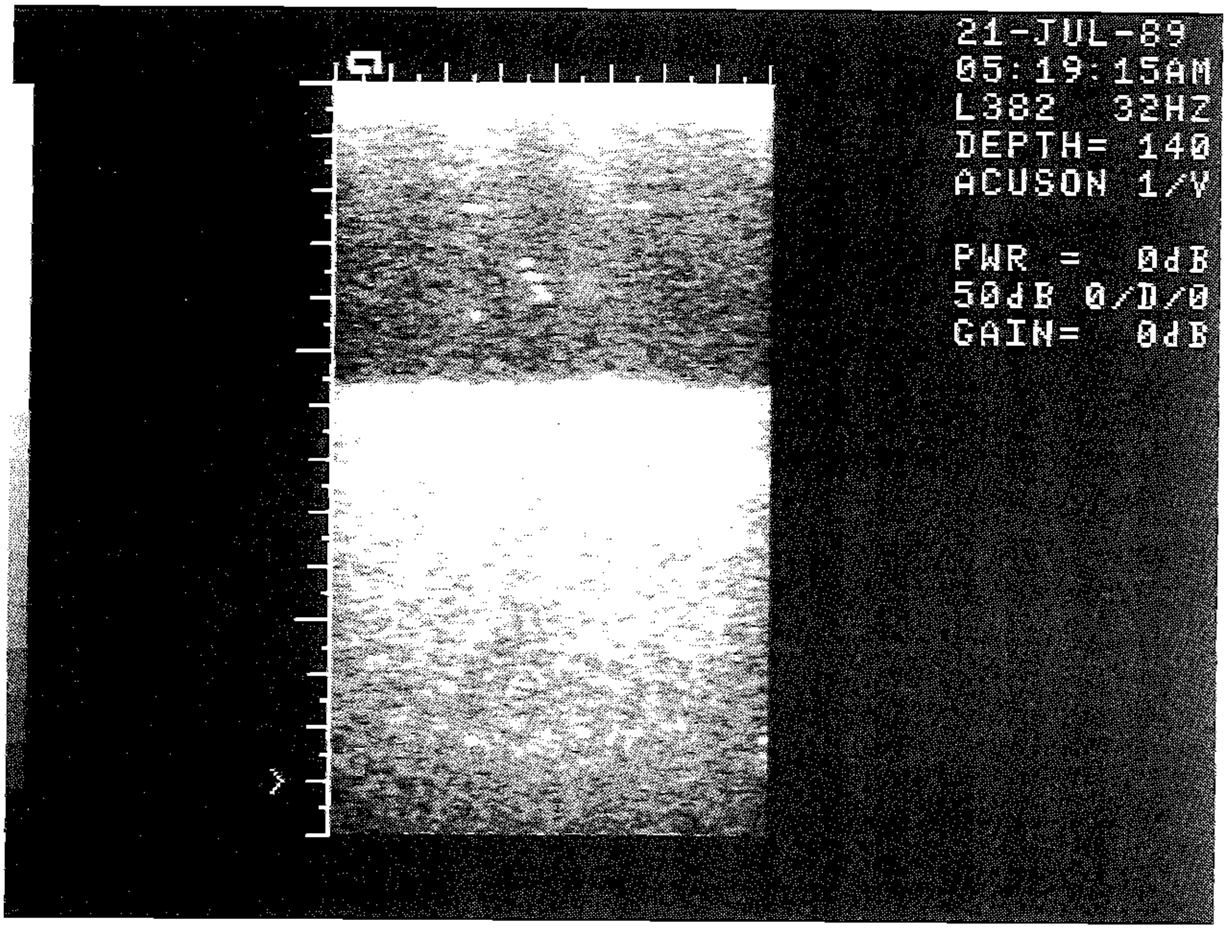


Figure 3-13. Interpolating Gain Driver — Internal Bus Low-Order Bit Failure

In this figure, the IGD board has lost a low order bit on the internal bus. The result with an L382 transducer is the faint, low gain band in the near field. This band changes as the DGC pots are varied.

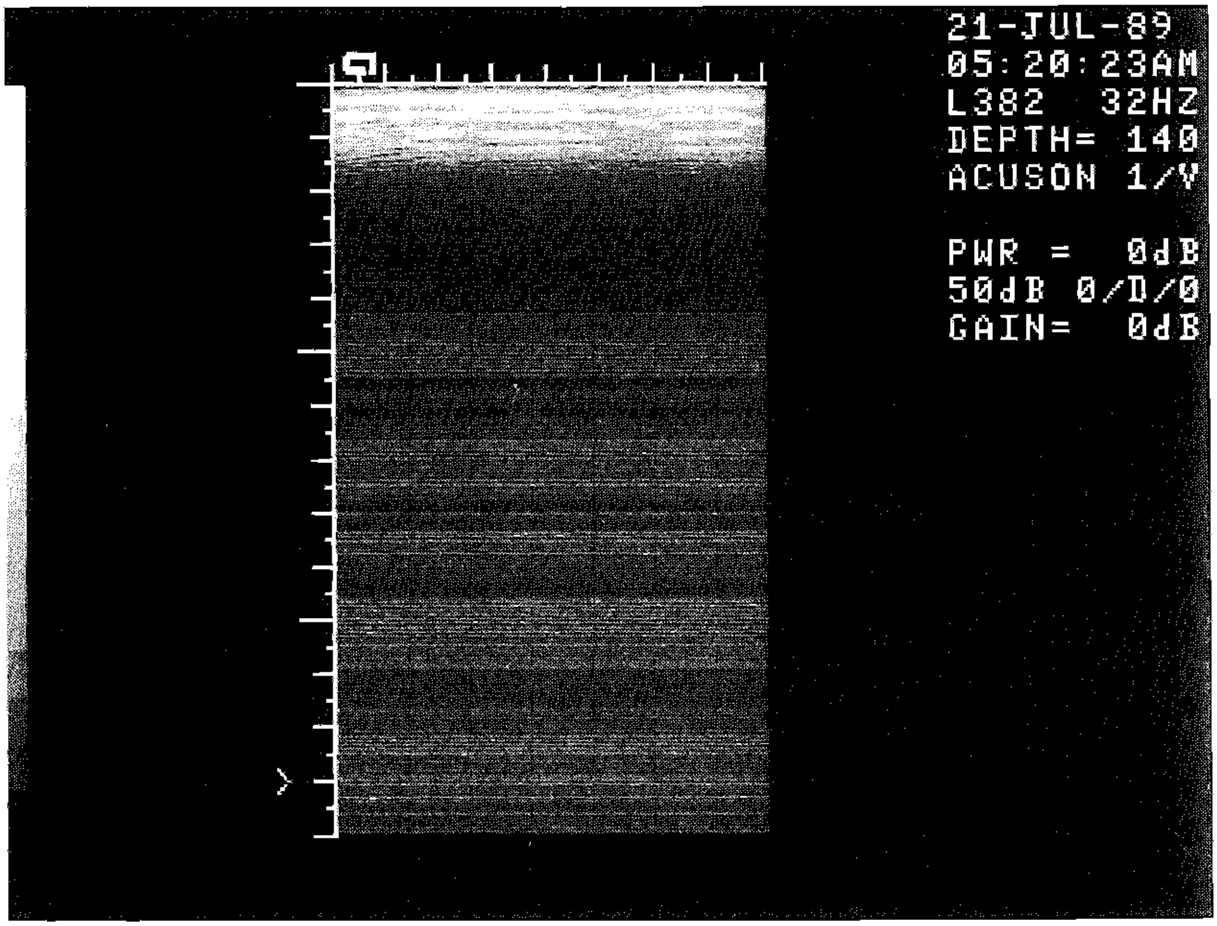


Figure 3-14. Interpolating Gain Driver — Internal Bus High-Order Bit Failure.

In this figure, the IGD board has lost a high-order bit on the internal bus. The result, with an L382 transducer, is the dark and light bands throughout the image area. These move about as the DGC pots are varied. Notice these bands are much smaller than those shown in Figure 3-13.

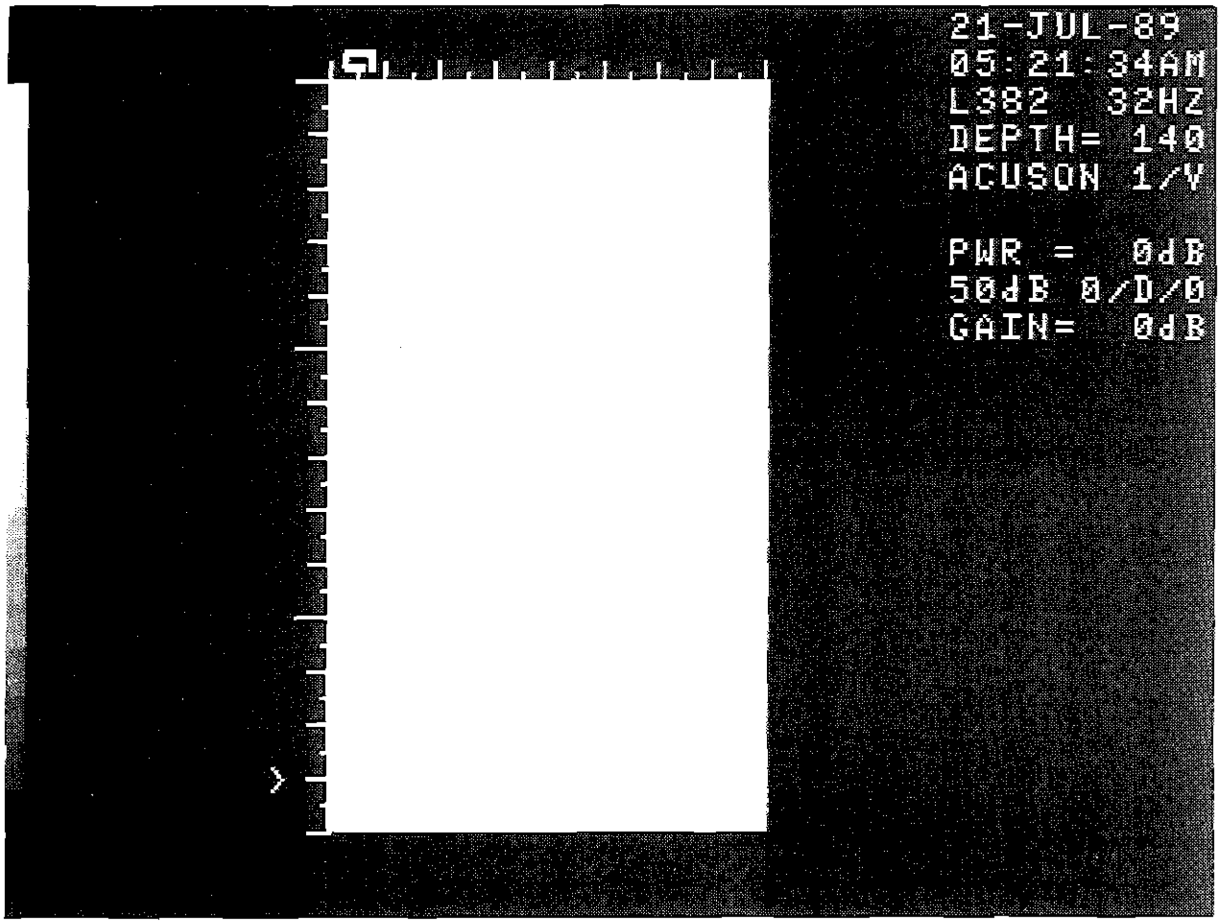


Figure 3-15. Interpolating Gain Driver — Complete Board Failure

With an L382 transducer, the image is either completely black or bleached white, regardless of the position of the DGC pots. The DGC gain is set to minimum, yet the image is almost completely saturated.

MEX — Memory Expansion Board

P/N:	MEX 2	16442T
Ejector Tab Color:	Red	
Quantity:	1 - 3	
Power Supplies:	+5V	
Buses:	P	
Signals In:	N/A	
Signals Out:	N/A	

Revision Requirements

MEX 2 Rev. 1 required for current software.

Function

The MEX is used as a storage area for control data for the various transducers. The data set for a particular transducer is programmed into a set of PROM's and then placed in sequential order on the MEX. When that particular transducer is connected to the system, its ID code is read and data from the corresponding PROM set is loaded into the DCC's. Data exits the MEX via the P bus.

The MEX 2 accommodates 32 PROM's. Each row of PROM's is jumper selectable for 128K, 256K or 512K PROM's. All PROM's currently manufactured are 512K. All the PROM's in a set must be adjacent to one another and arranged in ascending order.

Additional boards may be installed in the system by setting the address jumper (BD0, BD1, BD2) as appropriate for that board.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Parts of the MEX are tested when the system is turned on or reset. Failures of the MEX will be displayed as:

MEMEX(1,2,3) POWER UP ERROR

See the Scanner Troubleshooting section.

MXK — Mixer Clock Board

P/N:	MXK 1	10342T
	MXK 2	17932T
Ejector Tab Color:	Black	
Quantity:	4	
Power Supplies:	-7.5V, +5V	
Buses:	C	
Signals In:	Reference clock from STG	
Signals Out:	M00 - M31	

Revision Requirements

MXK 2 Rev. A required for CW Doppler.

MXK 1 Rev. 4 ok for all but CW Doppler.

Function

The Scanner has four Mixer Clock boards, with 32 channels each, providing a total of 128 channels. The purpose of the Mixer Clock is to generate a signal to mix with the received ultrasound signal to produce an intermediate frequency (IF). The output of each mixer clock channel is used to drive the mixer section of each associated Receiver channel. The Mixer Clock frequency changes with different Transducer types.

The MXK boards are controlled by microcode on the DCC-1 via the C bus. Logic on the MXK board buffers and latches control words from the C bus to configure the MXK boards for a particular ultrasound line. Addresses for the MXK boards are encoded into the motherboard connectors to identify each of the four MXK boards in the Scanner.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Visual Symptoms

Figure 3-16 illustrates the image when an entire MXK board has failed.

If a single MXK channel fails, the visual symptom are identical to that of a dead Receiver channel. Troubleshoot this type of problem as Receiver failure. If swapping the Receiver board associated with the problem area has no effect on the symptom, swap the associated MXK board.

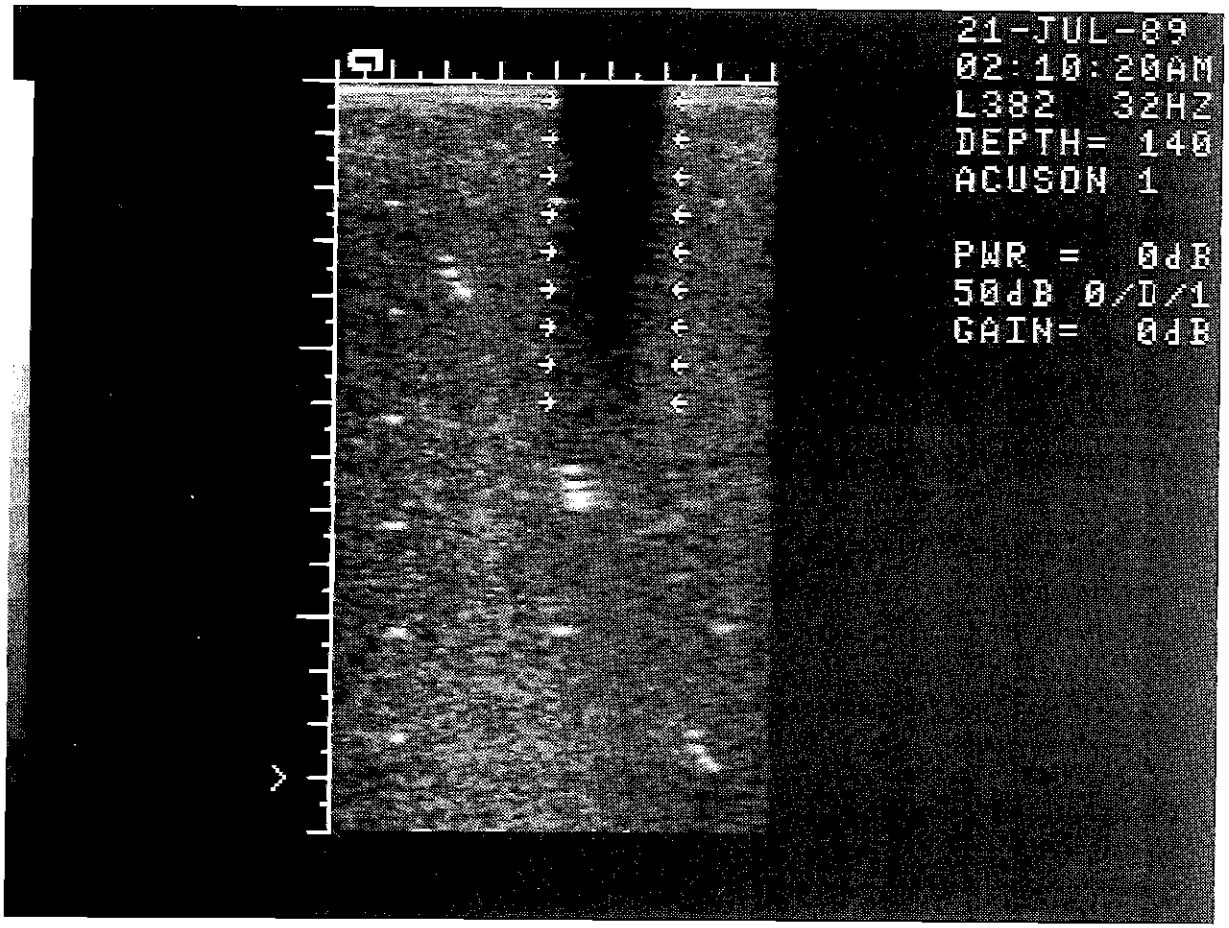


Figure 3-16. Mixer Clock — Complete Board Failure

Note the dark dropout area at the top of the image. With an L382 transducer the dropout zone is approximately 2 cm wide. This looks like a dropout due to a failed Receiver board, but is four times as wide, since each MXK board drives four Receiver boards. The dropout zone can be associated with the faulty MXK board by using the scale at the top of the image. This is a failure of MXK-2. The Mixer Clocks are numbered MXK-0 to MXK-3

RCV — Receiver Board

P/N:	RCV 1	10002T
	RCV 2	17912T
Ejector Tab Color:	Black	
Quantity:	8	
Power Supplies:	+15V, -15V, +5V	
Buses:	N/A	
Signals In:	MXK (8); APOD (8)	
Signals Out:	IF (4 cells)	

Revision Requirements

RCV 2 Rev. B required for CW Doppler.

RCV 2 Rev. A ok for all others.

RCV 1 Rev. 3 ok for all but CW Doppler.

RCV 1 Rev. B and RCV 2 may NOT be mixed with earlier revisions of RCV boards.

Function

The function of the Receiver board is to amplify the low level signal from the transducer elements and to convert the received signal to an intermediate frequency (IF) for further processing in the Scanner. Gain signals from the Apodizer boards and the Interpolating Gain Driver control the output level of the Receiver. The mixer frequency used to produce the IF signal is generated on the Mixer Clock boards. There are 16 Receiver boards in the Scanner and eight receiver cells on each board, thus giving 128 total cells.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Figures 3-17 through 3-22 illustrate typical Receiver board faults.

With a linear format transducer connected to the system, identify the faulty Receiver board by noting the location of the image artifact. There are 16 Receiver boards numbered 0-15 in the Acuson 128XP. Therefore, each Receiver corresponds to 1/16 of the image. Use the horizontal graticule to divide the image into sixteen equal segments and note which segment contains the artifact. The faulty Receiver is in the corresponding Scanner RCV slot.

For example, with an L382, the horizontal graticule is 8.2 cm wide. Dividing 8.2 cm by 16 Receiver boards results in just over 0.5 cm per Receiver board. Figure 3-17 shows a failure of the Receiver board in slot RCV-2. Note that the dropout area is in the third 0.5 cm segment on the horizontal graticule. (The RCV slots are labeled 0-15). Figure 3-18 shows a failure of the Receiver board in slot RCV-9. Note that the dropout area is in the tenth 0.5 cm segment on the horizontal graticule.

With a sector, curved, or Vector Array format transducer, locate failures of Receiver boards by swapping the positions of any two of the receiver boards. Look for a change in the image. Continue to swap pairs of Receiver boards until the image artifact moves. Once the defect is isolated to a pair of receiver boards, replace each board in turn to correct the problem.

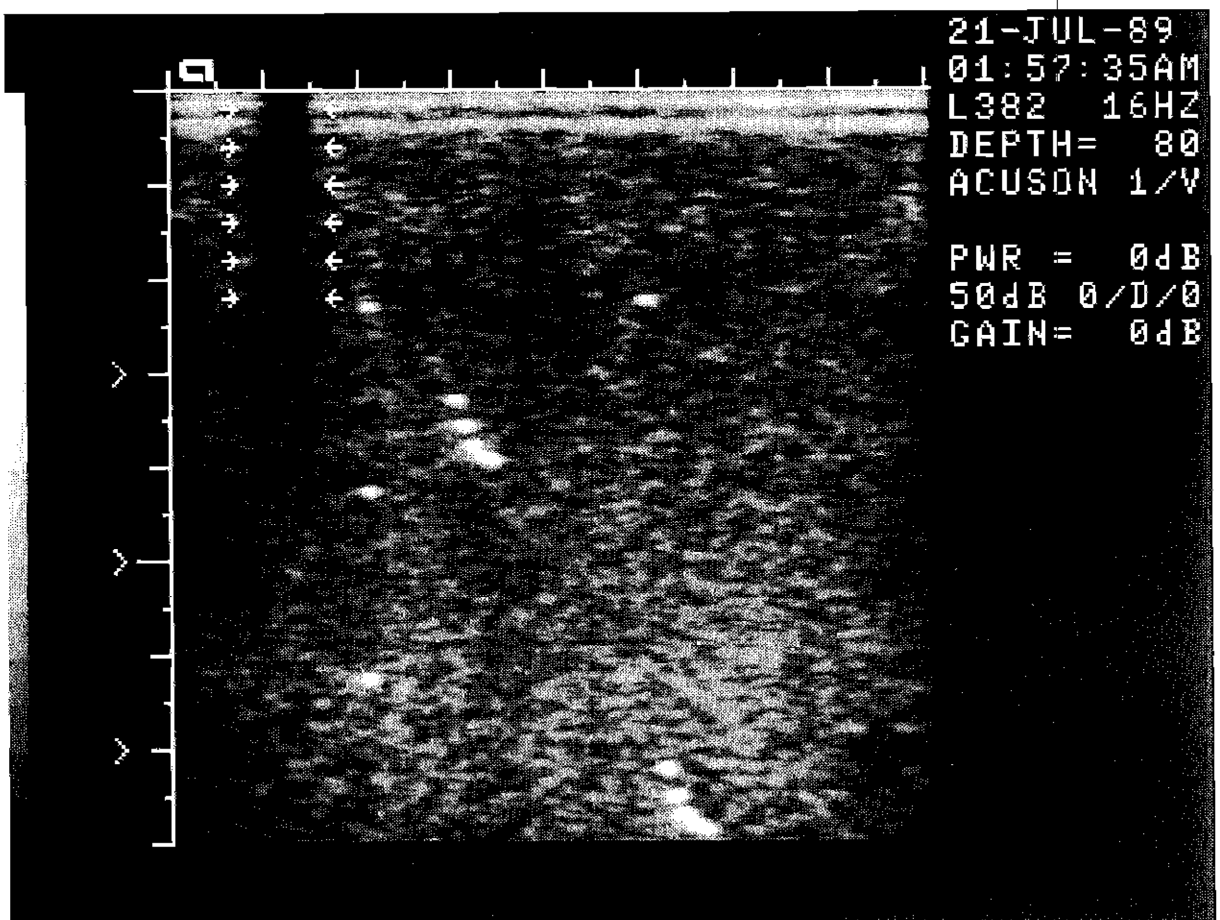


Figure 3-17. Receiver — Board RCV-2 Failure

This example shows an image when the Receiver board in slot RCV-2 has completely failed. An L382 Transducer is connected to the system. Notice the missing zone of information at the top of the image, approximately 0.5 cm wide. This dropout zone is completely black through the transmit ringdown area.

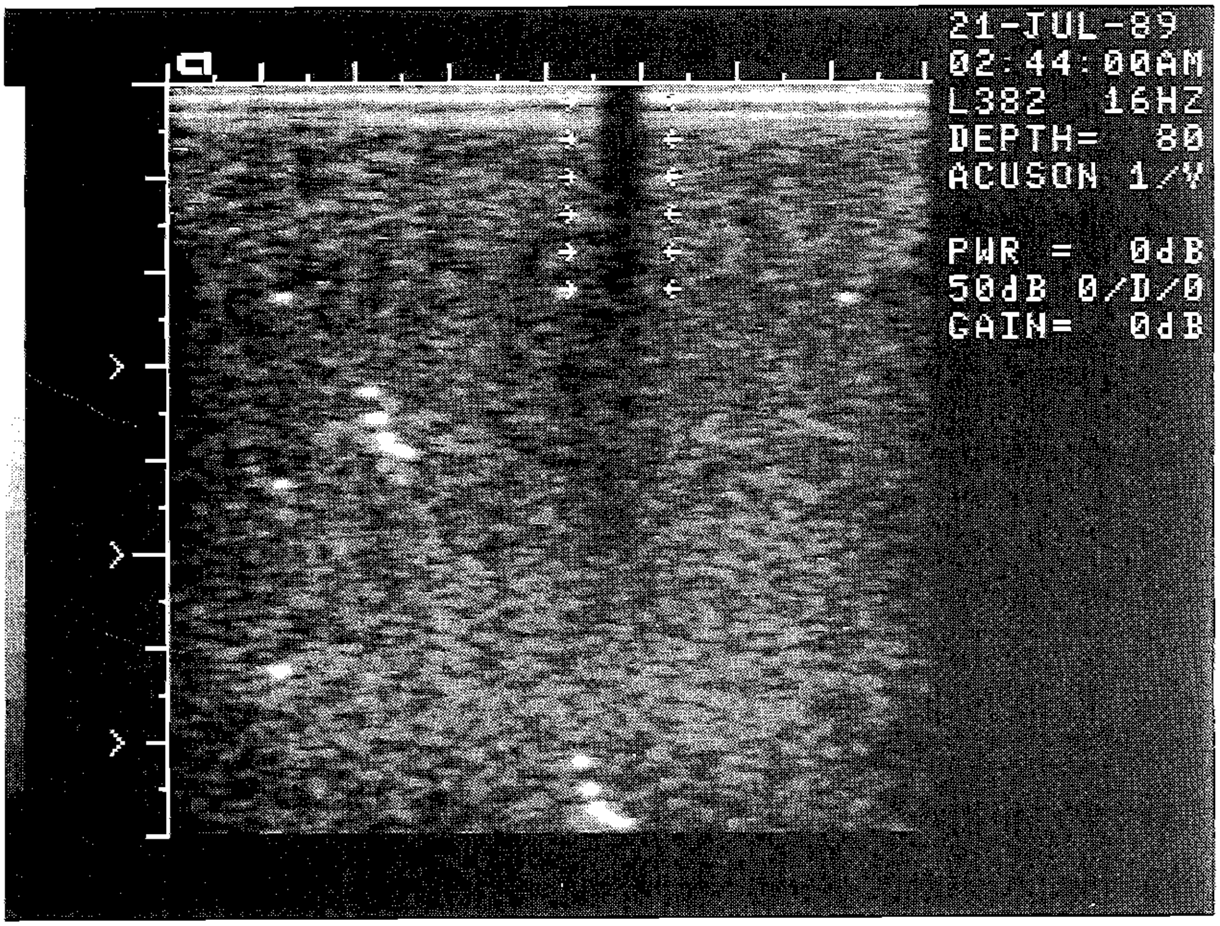


Figure 3-18. Receiver — Board RCV-9 Failure

This image shows a Receiver board failure similar to that shown in Figure 3-17, except here the defective Receiver board is in slot RCV-9.

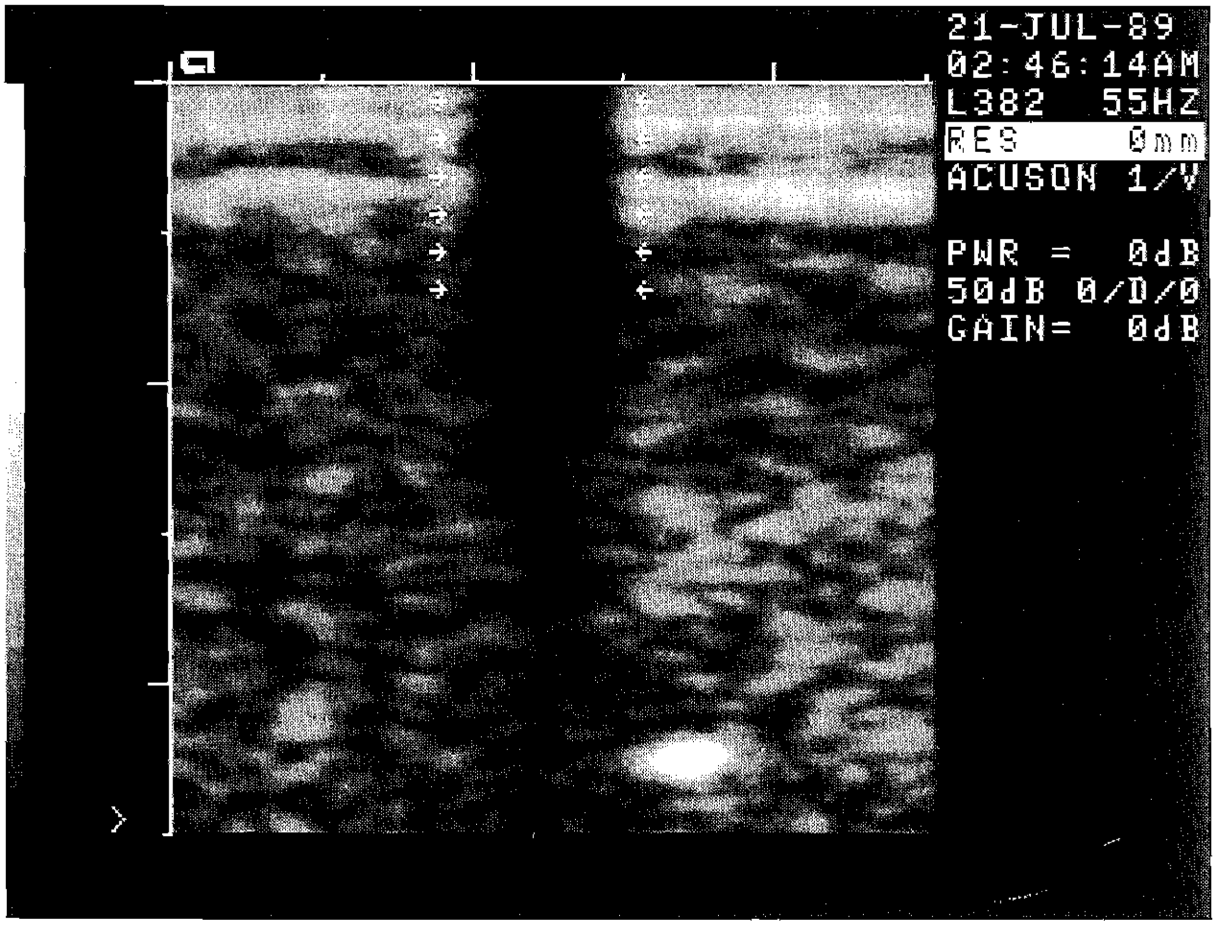


Figure 3-19. Receiver — Board Failure Seen with RES

This image shows RES used to inspect the dropout zone to determine a Receiver failure. Note that the dropout is completely black through the ringdown area of the image.

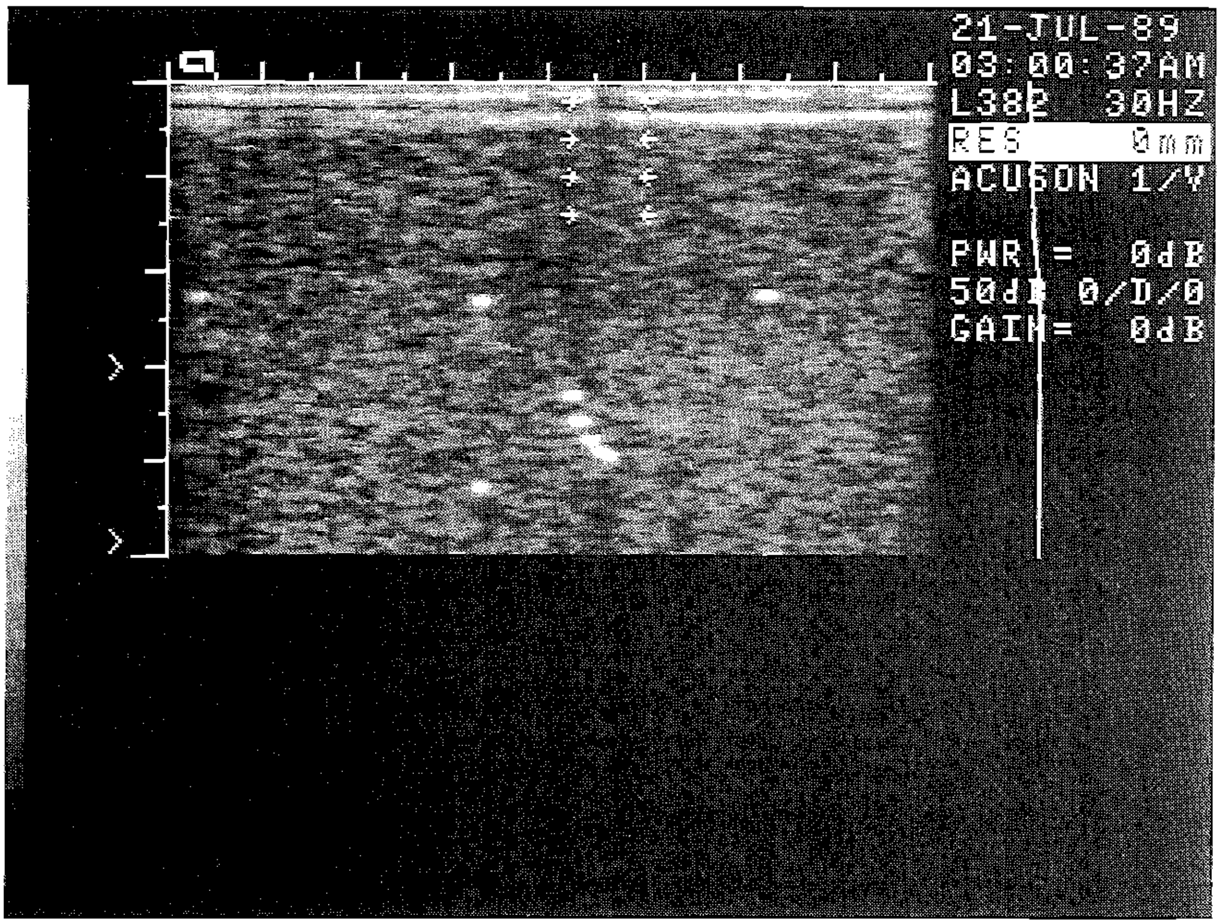


Figure 3-20. Receiver — Single Channel Failure

This L382 transducer image has a single failed Receiver channel on the Receiver board in slot RCV-9. Note the very faint dropout area at the top of the image. The dropout area may only be visible when the transducer is moved from side to side. This dropout zone can be associated with a particular Receiver board by using the top scale.

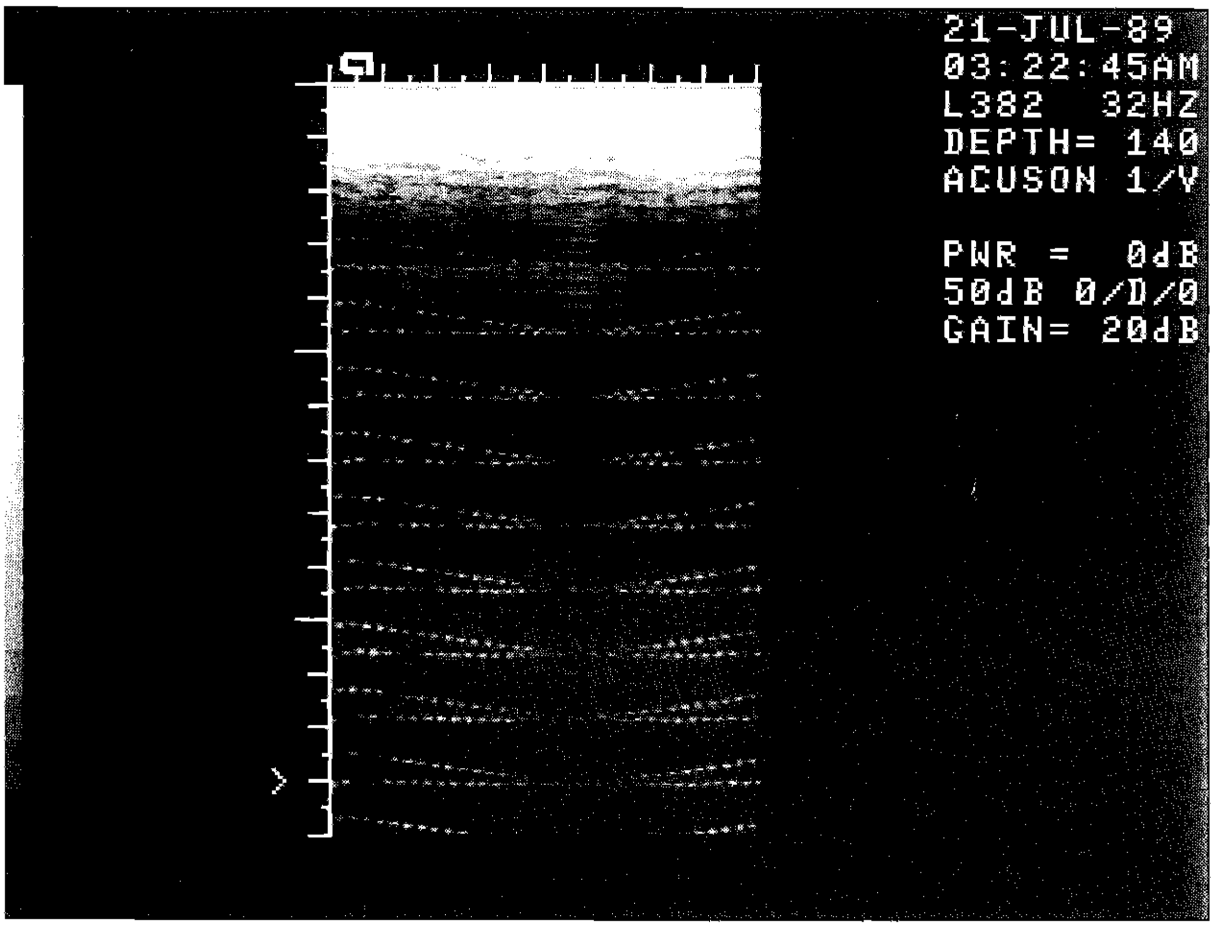


Figure 3-21. Receiver — Board RCV-9 Mixer Failure

This illustrates an L382 image from a system with a mixer failure on the Receiver board in slot RCV-9. Note the zigzag lines running through the image. Isolating the particular faulty Receiver board can be difficult. Try removing each Receiver board, one at a time, and inspecting the image. When the faulty Receiver board is removed, the lines disappear, leaving a dropout zone corresponding to the removed Receiver board.

WARNING!! Do not remove or install a PCB with the power on.

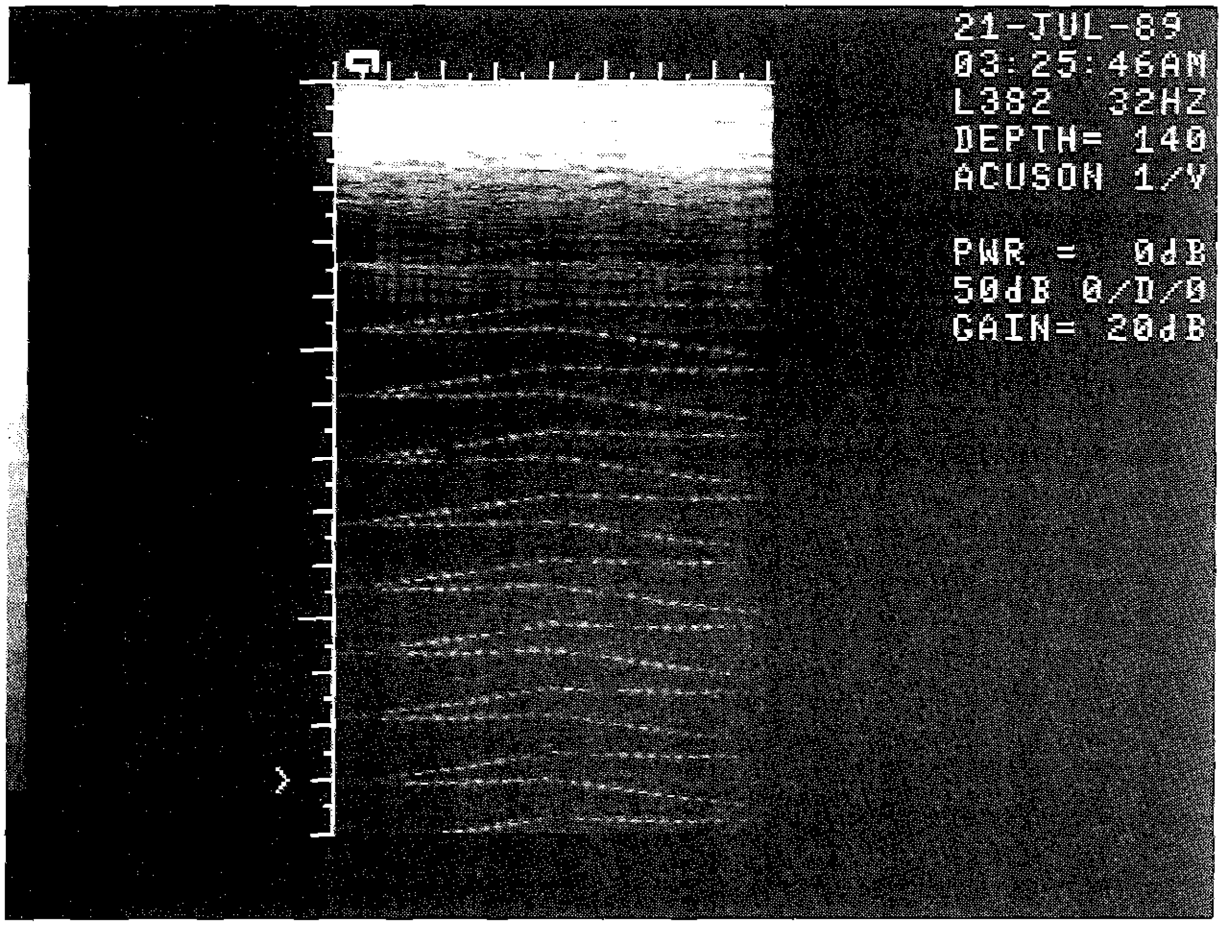


Figure 3-22. Receiver — Board RCV-0 Mixer Failure

This failure is similar to that shown in Figure 3-21. In this case the defective mixer is on the Receiver board in slot RCV-0.

SCP — Scanner Control Processor Board

P/N:	SCP 2	13132T
	SCP 3	18182T
Ejector Tab Color:	Red	
Quantity:	1	
Power Supplies:	+5V	
Buses:	P	
Signals In:	PERCLK, 5 MHz (STG),	
Signals Out:	SYSRST, DPR handshake signals	

Revision Requirements

SCP 3 required for CW Doppler, Rev. H or higher for DCC 3.

SCP 3 Rev. A ok for all systems.

SCP 2 Rev. 3 ok for all but CW Doppler.

SCP 1 no longer supported.

Function

The SCP's function is to control the operation of the Scanner. The heart of the SCP is a microprocessor and related support devices. The CPU is driven by the 5 MHz clock generated on the STG board. The firmware program for the processor is stored on three EPROM's. Two EPROM's are located on the SCP and one EPROM is located on the MEX. This allows the Scanner operating system to be upgraded by simply changing these three EPROM's.

The SCP communicates to the other digital control boards via the P bus.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Some aspects of SCP operation are verified when the system is turned on. Problems with the SCP may generate messages such as:

SCP POWER UP ERROR

S.INTRPT POWER UP ERROR

See the Scanner Troubleshooting section.

SDL — Summing Delay Line Board

P/N:	SDL 1	10322T
	SDL 2	18132T
Ejector Tab Color:	Green	
Quantity:	8	
Power Supplies:	+7.5V, -7.5V, +5V	
Buses:	A	
Signals In:	RCV paired IF	
Signals Out:	IF SUM (8 RCV Channels)	

Revision Requirements

SDL 2 Rev. A or higher is required for CW Doppler systems.

SDL 1 Rev. 1 is ok for all others.

Function

There are eight SDL boards in the Scanner. Each SDL receives the output of a pair of RCV 's. The output of each SDL board is then sent to the Distribution Board Left, where all eight SDL board outputs are summed together. The SDL boards are controlled by DCC-0 via the A bus. Logic on the SDL board buffers and latches the control words from the A bus to configure the SDL for a particular ultrasound line. Addresses for the SDL boards are encoded into the connectors in the motherboard to identify each of the eight SDL boards in the Scanner.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Measurable Symptoms

SDL board failure or low gain can be detected by using a digital volt meter to measure the voltage at the test points provided at the top of the SDL board. Connect the common lead of the DVM to TP0, and with the positive lead, measure:

- TPI +5.00 V, ±.10 V
- TP2 -5.00 V, ± .10 V

If the measured voltage readings fall outside those specified, replace the SDL board.

Visual Symptoms

With a linear format transducer connected to the system, identify a faulty SDL board by noting the location of the image artifact. There are 8 SDL boards numbered 0-7 in the Acuson 128XP. Therefore, each SDL corresponds to 1/8 of the image. Use the horizontal graticule to divide the image into eight equal segments and note which segment contains the smaller artifact. The faulty SDL is in the corresponding Scanner SDL slot.

For example, with an L382, the horizontal graticule is 8.2 cm wide. Dividing 8.2 cm by eight SDL boards results in just over 1.0 cm per SDL board. Figure 3-23 shows a complete failure of the SDL board in slot SDL 0. Note that the smaller dropout appears in the first centimeter as shown on the horizontal graticule. Figure 3-24 shows a complete failure of the SDL board in slot SDL 5. Note that the smaller dropout appears in the sixth centimeter as shown on the horizontal graticule.

With a sector, curved, or Vector Array format transducer, locate failures of SDL boards by swapping the positions of any two of the SDL boards. Look for a change in the image. Continue to swap pairs of SDL boards until the image artifact moves. Once the defect is isolated to a pair of SDL boards, replace each board in turn to correct the problem.

Figures 3-23 through 3-26 illustrate typical SDL failures. Figures 3-23, 3-24 and 3-25 show failures of a complete SDL board. Figure 3-26 shows the failure of a single channel on the SDL board.

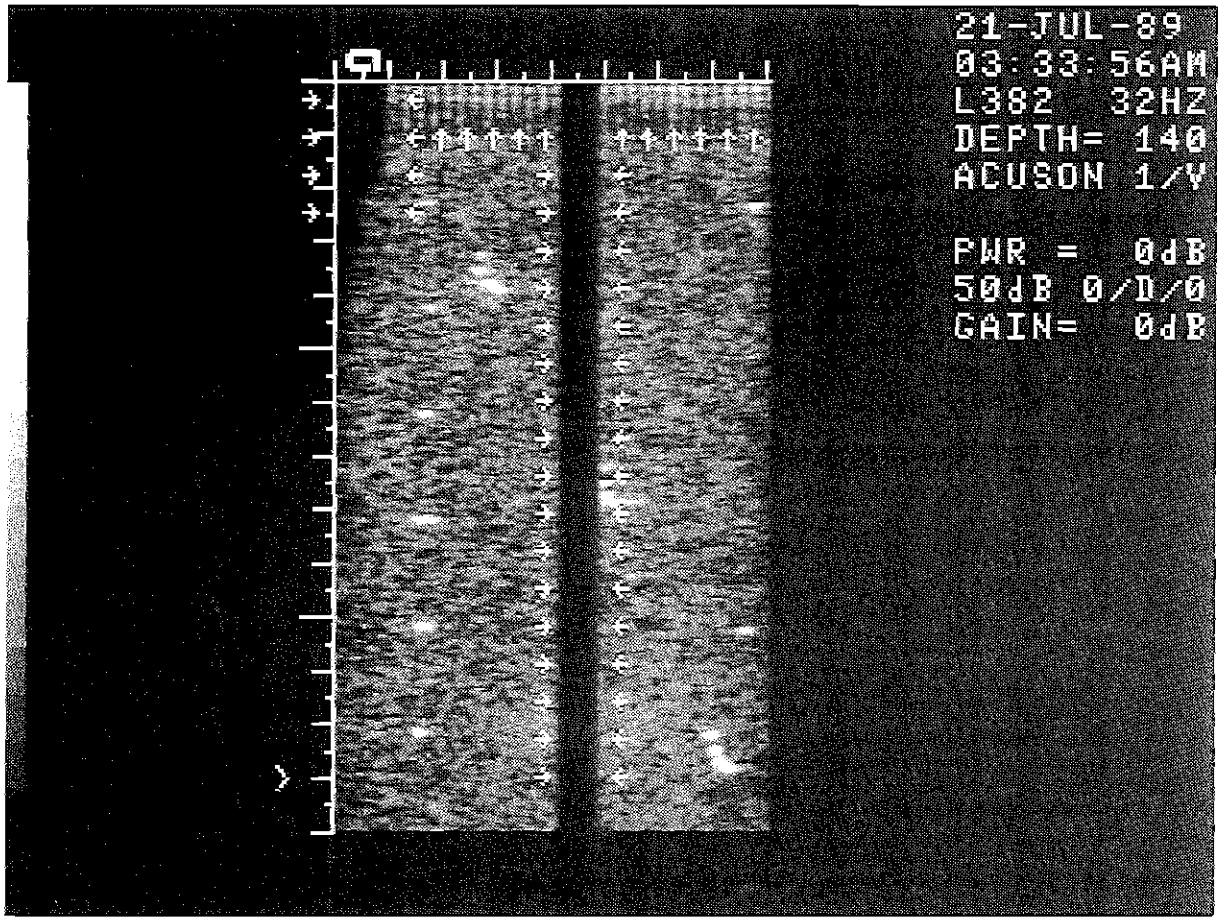


Figure 3-23. Summing Delay Line — Complete Failure of SDL Board in Slot SDL-0

This L382 image shows a complete failure of a Summing Delay Line board. The DGC pots are set at full gain. Note the missing zone of information that appears at the upper left of the image, approximately 1 cm wide. This dropout zone will resemble that of a failed Receiver board, but will be twice as wide, since the SDL board sums the output of two Receive boards. Also note the bar dropout extending from the top to the bottom of the image. The position of this artifact will not correspond to the SDL board that has failed but it will always be present.

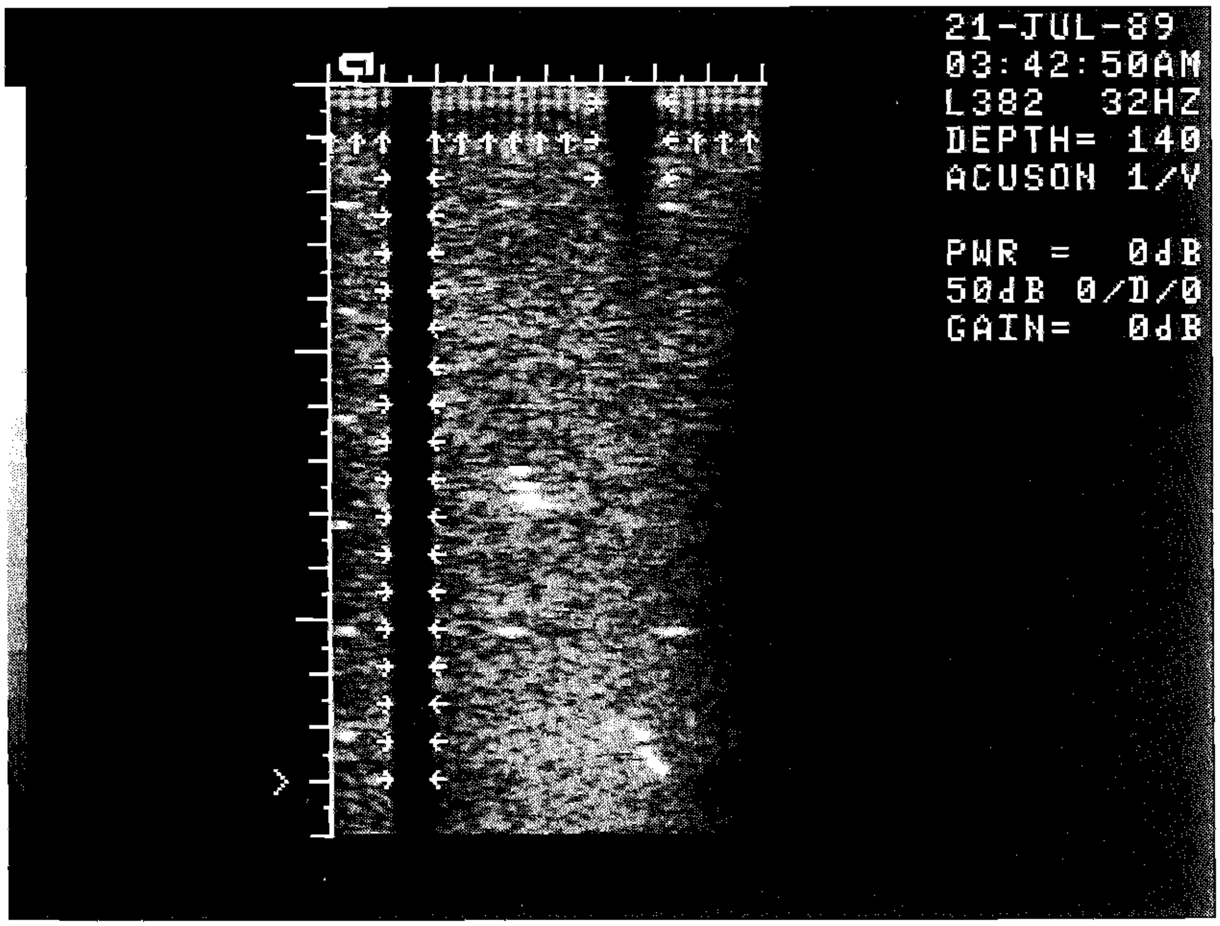


Figure 3-24. Summing Delay Line — Complete Failure of SDL Board in Slot SDL-5

This image is similar to Figure 3-23 except that the SDL board in slot SDL 5 has failed. Note the smaller artifact is now located in the sixth centimeter as measured on the horizontal graticule (SDL boards are numbered 0-7).

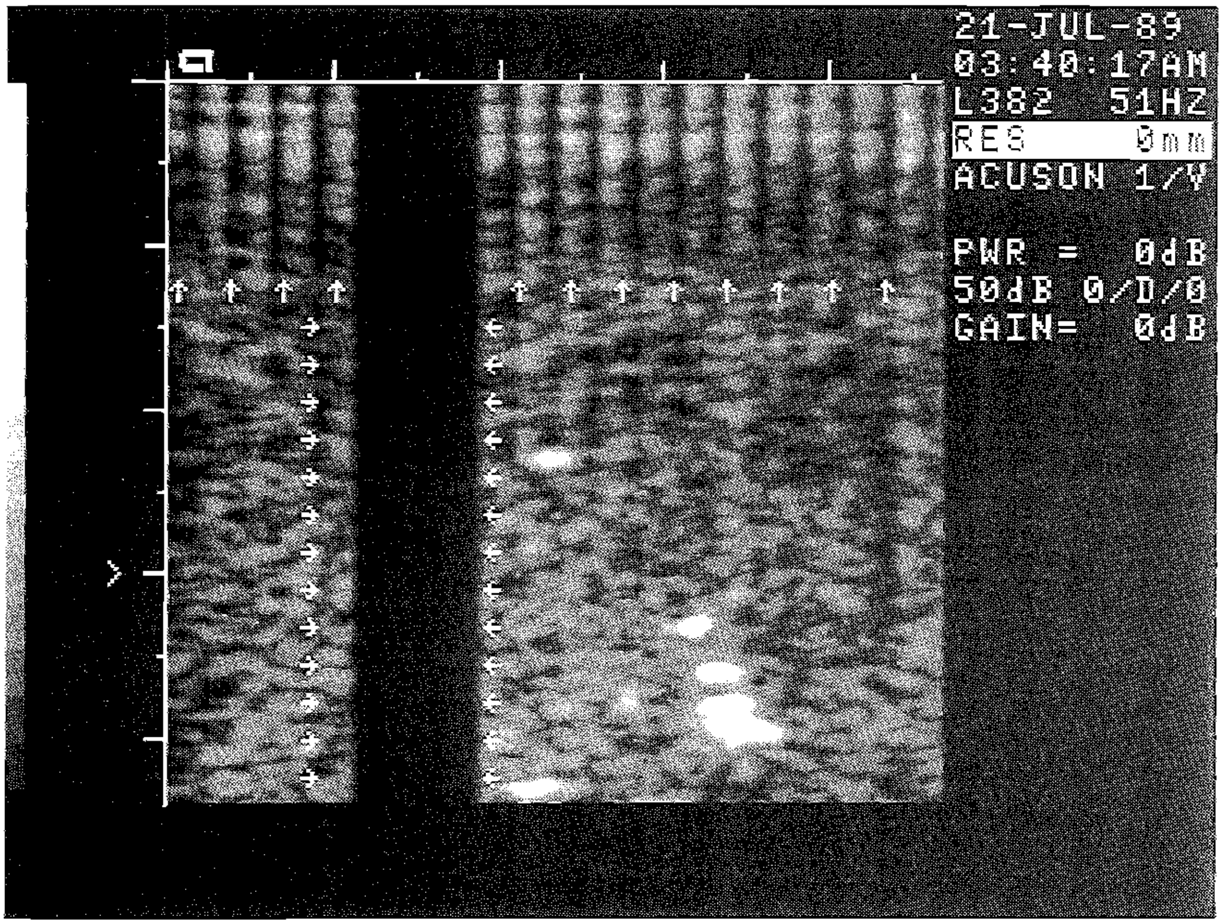


Figure 3-25. Summing Delay Line — Comb Artifact with RES.

This illustration uses the RES function to show the comb-like pattern characteristic of SDL failures.

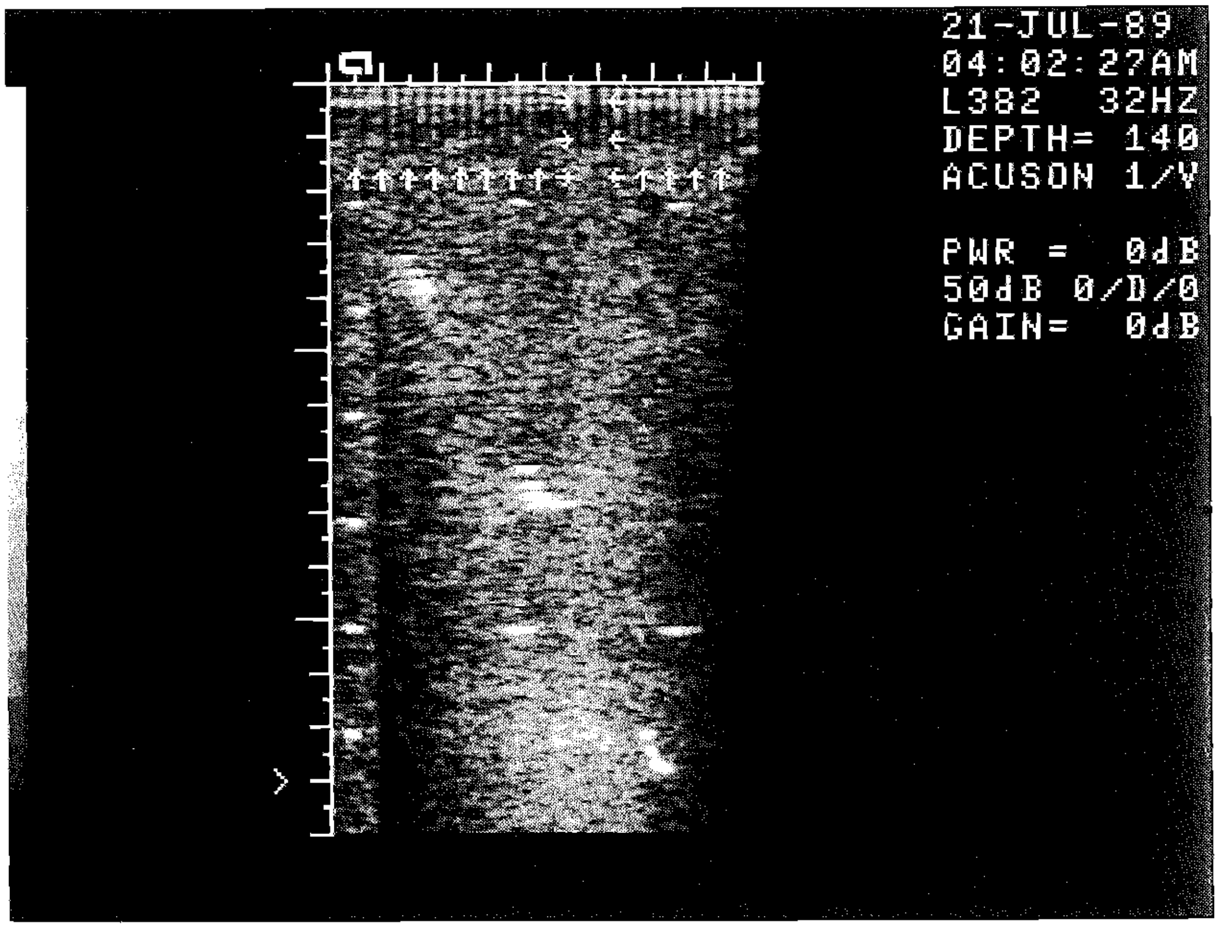


Figure 3-26. Summing Delay Line — Failure of SDL Channel #80

The failure of a single SDL channel is difficult to observe. It appears as a faint, narrow dropout zone (approximately 2 mm wide when using an L382). Note the comb-like artifact characteristic of SDL failures.

SGD — Scanner Gain Driver Board

P/N:	10382T
Ejector Tab Color:	Green
Quantity:	1
Power Supplies:	+15V, -15V, +5V
Buses:	D
Signals In:	Interpolated gain values from the SGI.
Signals Out:	VBIAS, VGAIN, VA BIAS, Video Gain, VXMT Bias

Revision Requirements

SGD Rev. 6 required for Pulsed Doppler.

SGD Rev. 5 ok for all others **except** CW and color Doppler systems.

Use an IGD instead of an SGI/SGD pair in CW and color Doppler systems.

Function

The SGD board contains seven D/A channels which control the gain requirements of the Scanner. The SGD uses five of the seven channels; two channels are reserved for future use. The SGD drives the following:

- Receiver Gain
- Receiver Bias
- Transmit Power
- Video Gain
- Apodizer Bias

The Apodizer reference level is also generated on the SGD board.

The SGD is controlled by microcode on DCC -1 via the D bus. Logic on the SGD buffers and latches control words from the D bus to configure the SGD for a particular gain format.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Measurable Symptoms

Verify that the proper voltages are present on TP 6 and TP 9.

VA REF (TP6) will remain a steady -1.7 VDC.

With a sector transducer connected, the VXMT BIAS (TP9) will vary from 4 to 10 VDC as the transmit power is varied.

Test points available on the SGD:

Test Point	Signal
TP0	Common Terminal
TP1	V BIAS
TP2	VA BIAS
TP3	V GAIN
TP4	VIDEO GAIN
TP5	VT- on-board DAC compensation
TP6	VA REF
TP7	not used
TP8	not used
TP9	VXMT BIAS
TP10	VR -DAC reference voltage

Visual Symptoms

Figures 3-28 through 3-32 illustrate the image when the individual signal lines of the SGD have failed.

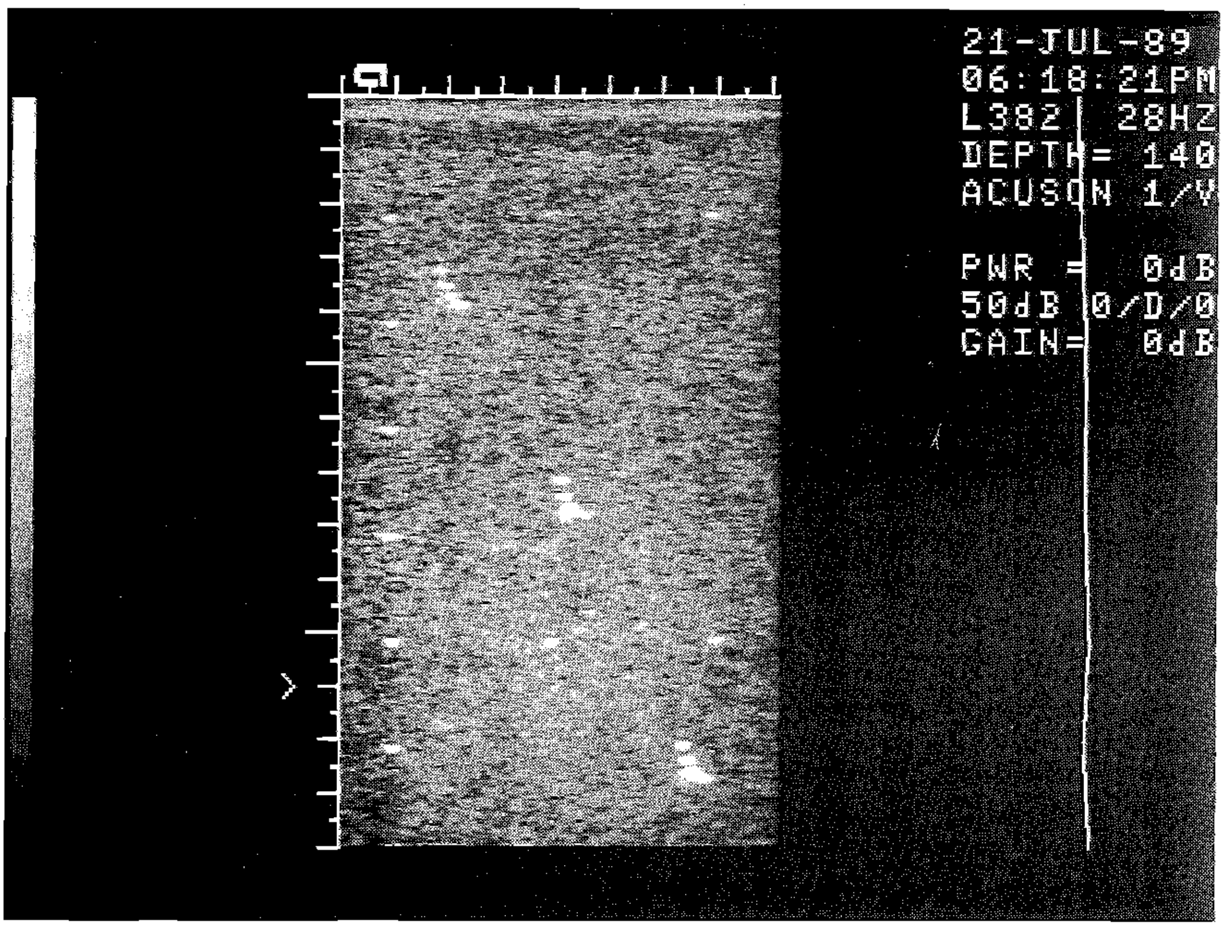


Figure 3-27. Scanner Gain Driver — Correct Operation

This is a normal image with the same control settings as those in Figure 3-31.

Figure 3-28. Scanner Gain Driver — No VGAIN Output

Note the DGC controls are set to minimum, yet the gain level seems almost saturated. The gain controls have a minimal affect on the image.

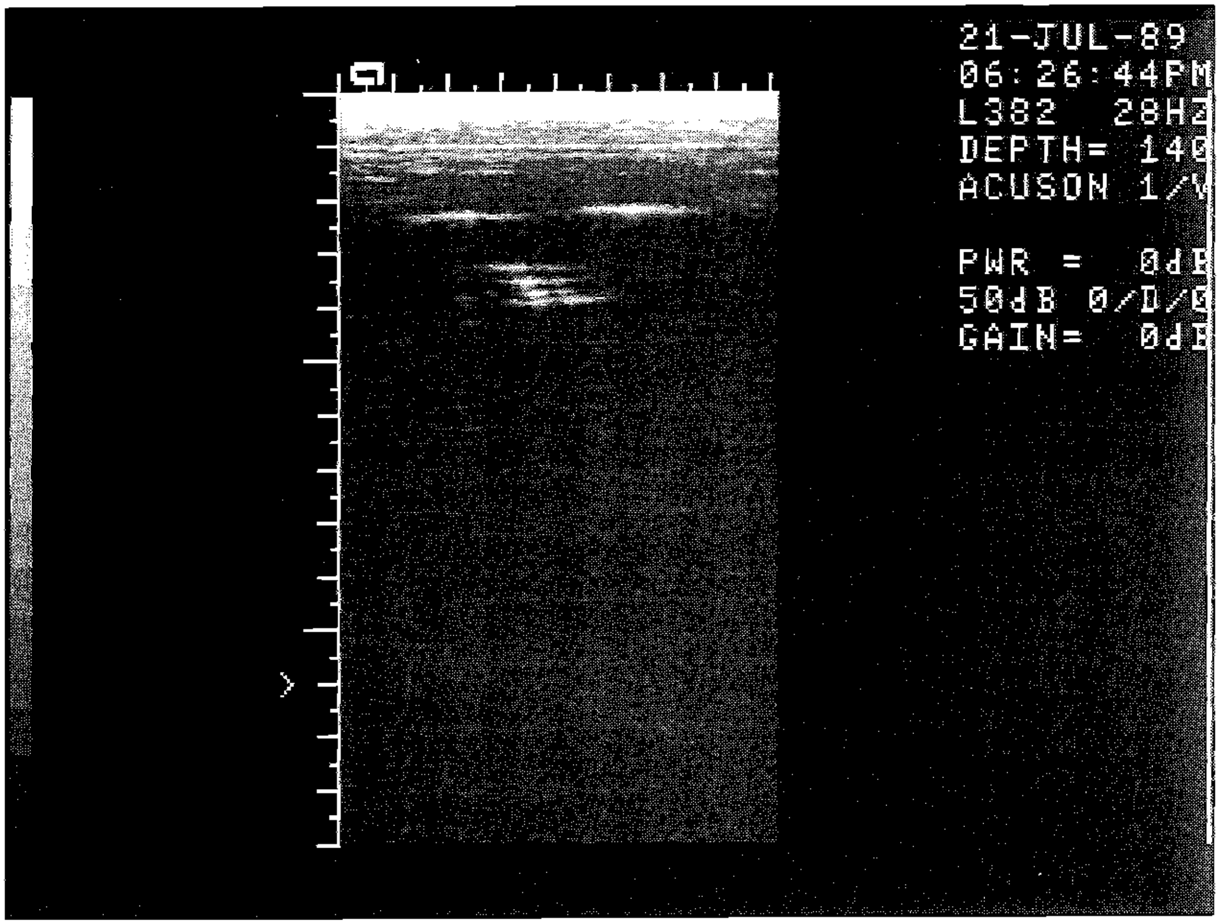


Figure 3-29. Scanner Gain Driver — No VBIAS Output

Note the DGC controls are at maximum and the ringdown and mixer clock noise are visible in the image, yet the image from the phantom is not visible.

Figure 3-30. Scanner Gain Driver — No VXMT BIAS Output

With no VXMT BIAS signal, there is no transmit signal. Note the lack of transmit ringdown in the image. This symptom is very similar to a loss of the 150V power supply.

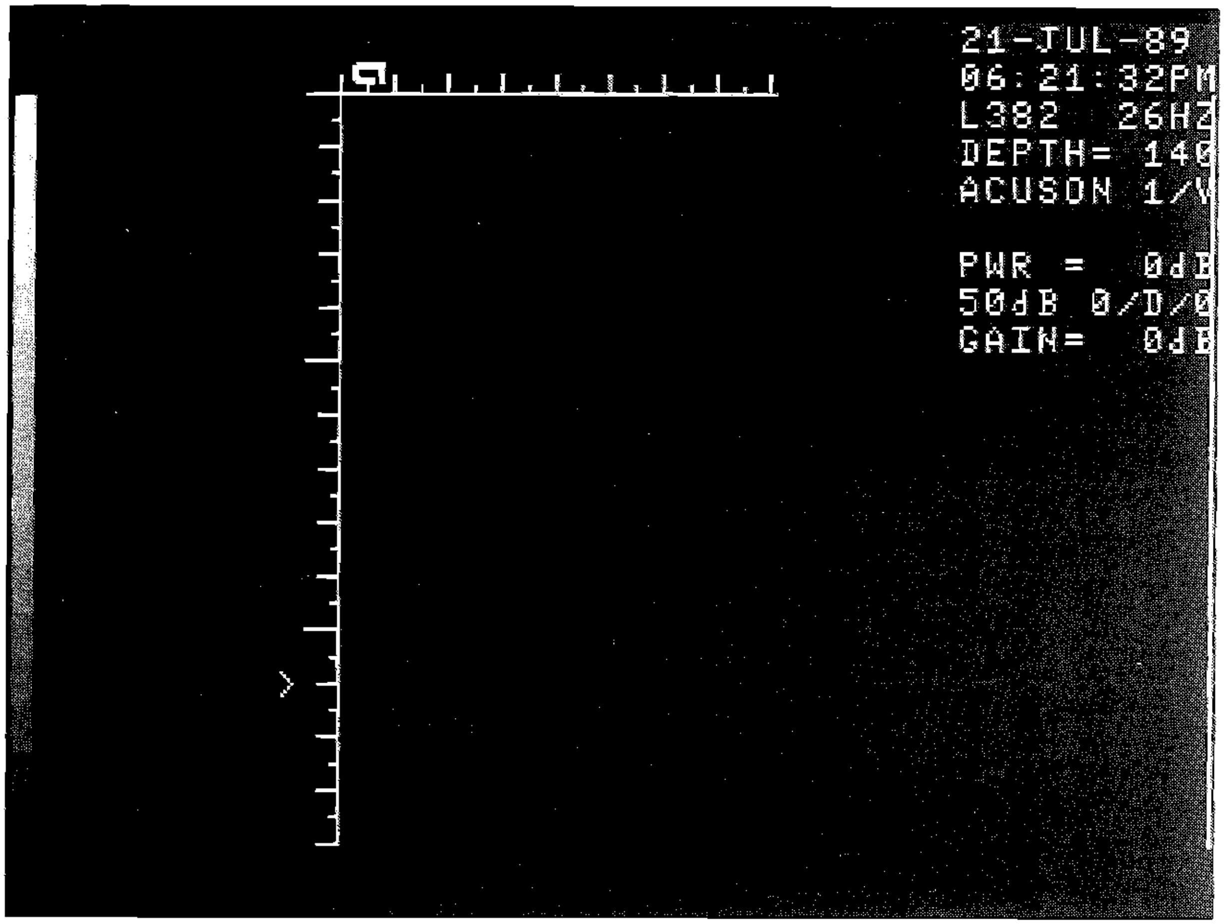


Figure 3-31. Scanner Gain Driver — No VIDEO GAIN Output

With no VIDEO GAIN signal, the image is entirely black. This symptom is similar to a dead 15V or 7.5V power supply.

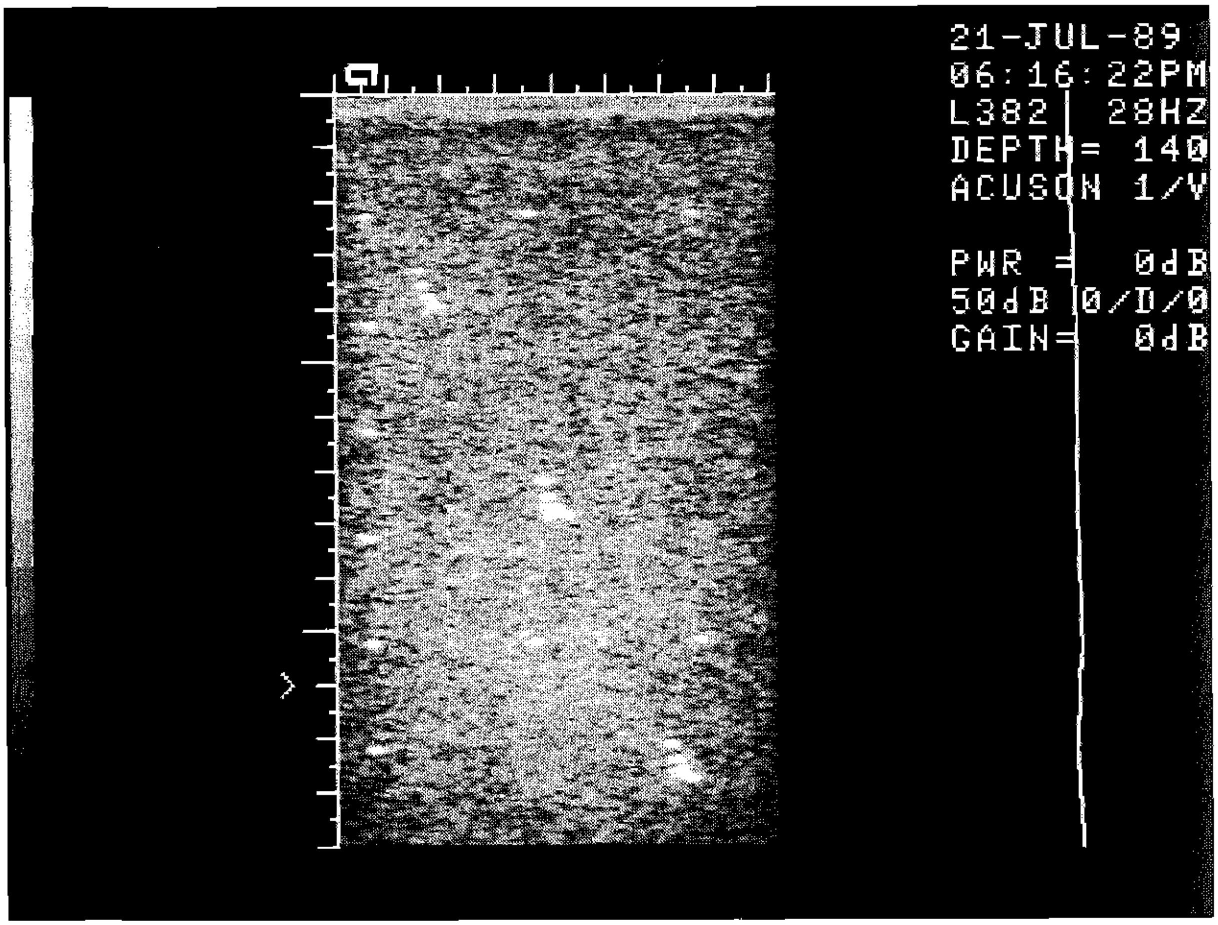


Figure 3-32. Scanner Gain Driver — No VA BIAS Output

This image has no VA BIAS output. Note the uneven gain and smeared targets.

SGI — Scanner Gain Interpolator Board

P/N:	10492T
Ejector Tab Color:	Green
Quantity:	1
Power Supplies:	+5V
Buses:	D
Signals In:	N/A
Signals Out:	N/A

Revision Requirements

SGI Rev. 2 ok for all systems except CW or color Doppler.

For CW or color Doppler systems, replace the SGI/SGD pair with an IGD.

Function

The SGI board is a link between DCC-1 and the Scanner Gain Driver board (SGD) and is used to perform high speed interpolation of control words to the SGD board.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Figures 3-33 and 3-34 illustrate the image when the SGI has an internal bus problem. With an L382 transducer connected, there are low gain bands through the image, which will move about as the DGC pots are varied.

Figure 3-35 illustrates the image when the SGI board has completely failed. With an L382 transducer connected, the image is either be completely black or the system gain goes to maximum, regardless of the position of the DGC pots.

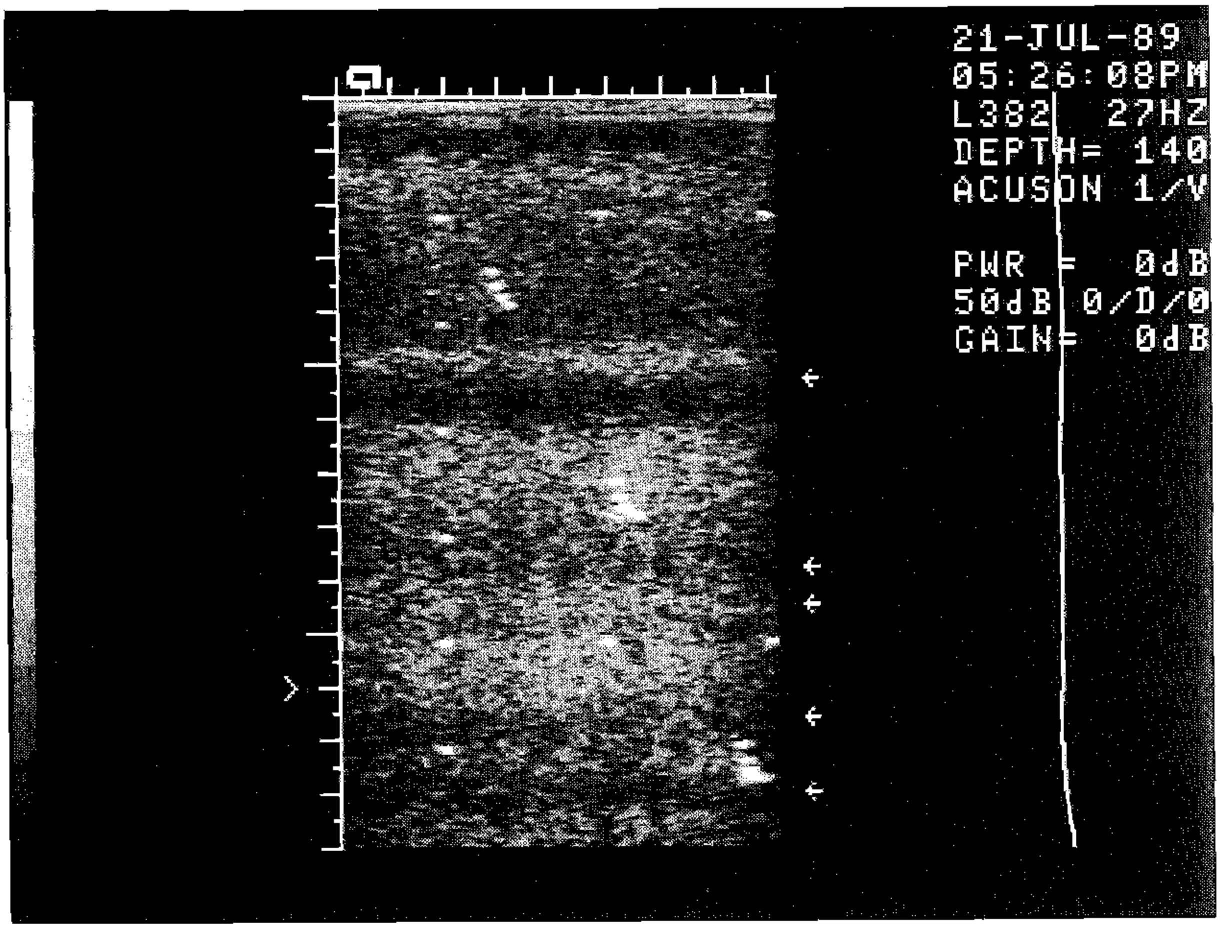


Figure 3-33. Scanner Gain Interpolator — Internal Bus Failure; Low Order Bit

The SGI board has lost a low-order bit on the internal bus and the result is the faint, low gain bands located by the arrows.

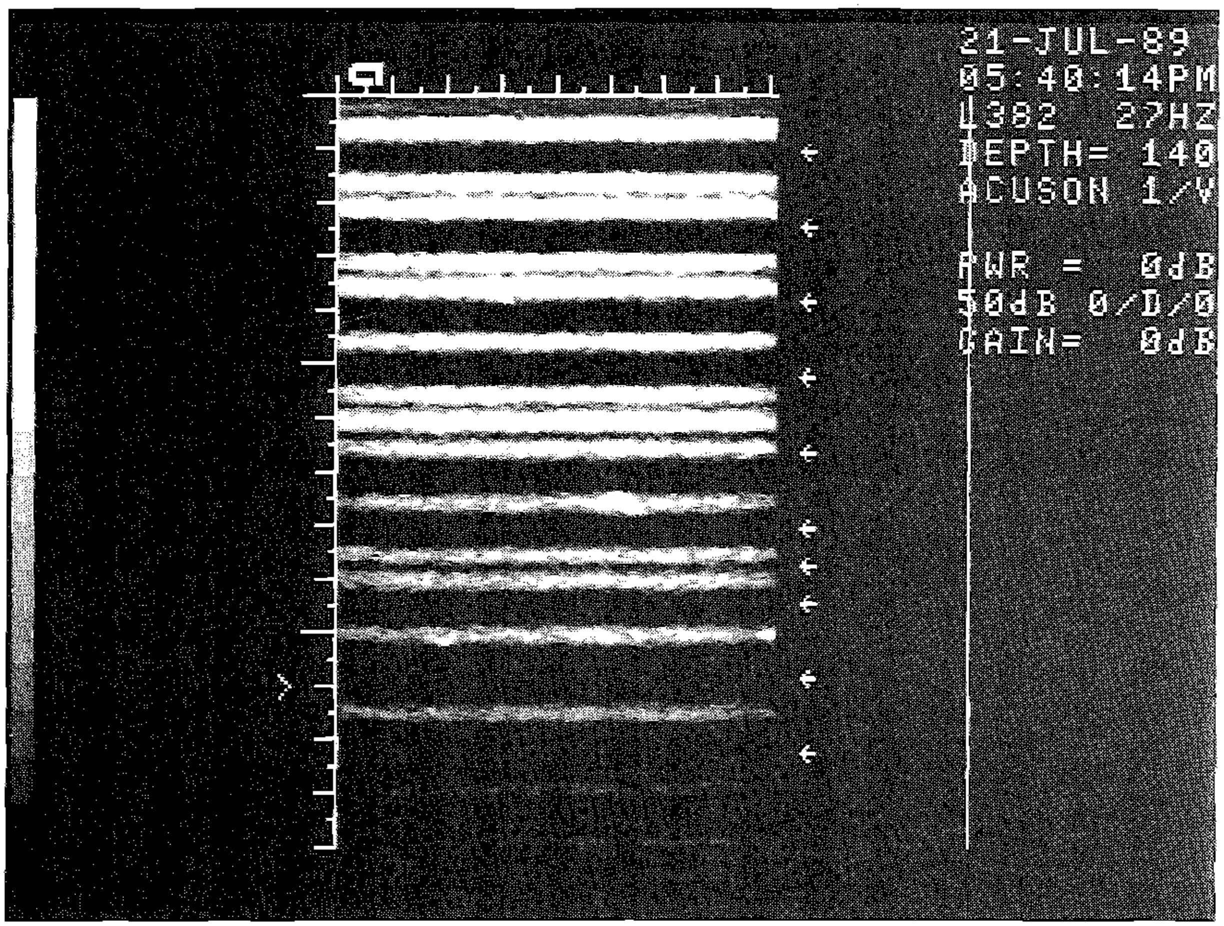


Figure 3-34. **Scanner Gain Interpolator — Internal Bus Failure; High Order Bit**

This illustration is similar to Figure 3-33. In this case, a higher-order bit is lost and the bands are darker.

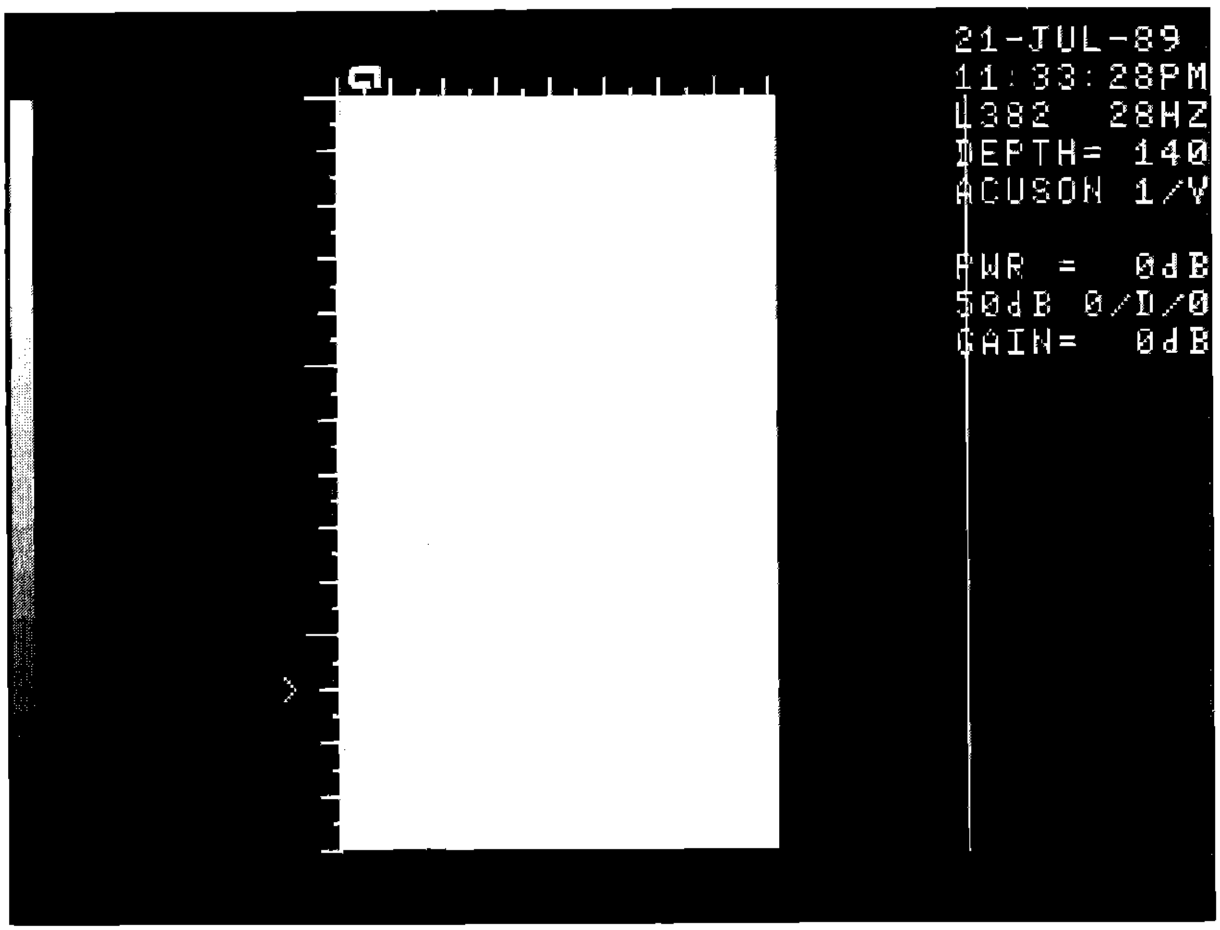


Figure 3-35. Scanner Gain Interpolator — Complete Board Failure

This is an image when the SGI board has completely failed. The image will either be completely black or bleached white, regardless of the position of the DGC pots. Note the DGC curve is at minimum gain yet the image is almost completely saturated.

SMB — Scanner Motherboard

P/N:	10362T
Ejector Tab Color:	N/A
Quantity:	1
Power Supplies:	+15, -15, +7.5, -7.5, +5, -5, 150V
Buses:	A, B, C, D, P
Signals:	All Scanner signals.

Revision Requirements

None.

Function

The Scanner Motherboard is a multi-layer, impedance-matched PC board. It provides the interconnection between each of the Scanner circuit boards. There are approximately 8400 pins that are press-fit into the board. No solder connections are used. This adds to the reliability of the Scanner. The PC board contains 10 conductive layers of etching. See Figure 3-5.

Troubleshooting

The SMB provides an interconnect path for virtually everything in the Scanner card cage. Due to the variety of SMB failures that are possible, and the number of test points that would need to be verified, the only practical means of troubleshooting the SMB board is to replace it. Replace the SMB only if all other possible causes for a given failure are ruled out. There are no active components on the board so failures are unlikely. Most failures are caused by debris in the edge connectors and bent pins.

STG — Scanner Timing Generator Board

P/N:	STG 1	10432T
	STG 2	14162T
	STG 3	17782T
	STG 4	18512T
Ejector Tab Color:	Red	
Quantity:	1	
Power Supplies:	+15V, -15V, +5V	
Buses:	P	
Signals In:	SYSRST	
Signals Out:	All Scanner clocks.	

Revision Requirements

STG 4 Rev. A required for CW Doppler, Vector Array, curved array.*

STG 4 Rev. K required for S2194 transducer.*

STG 4 requires PDB Rev. H.

STG 3 Rev. B required for 5 MHz cardiac transducers and all 7 MHz transducers.

STG 2 Rev. 6 required for Doppler.

STG 1 Rev. 5 ok in B/W, non-Doppler systems.

*Refer to section on System Switch Configurations for proper jumper settings.

Function

The STG generates all of the timing signals used in the Scanner. The heart of the STG is a high frequency crystal oscillator which feeds a divider network and generates the 10 MHz REFCLK signal to which all timing in the Scanner is synchronized.

A programmable timing generator located on the STG generates the following signals:

SOL	Start of Line
SOT	Start of Transmit
VSOT	Virtual Start of Transmit
VSOR	Virtual Start of Receive

The period of each of these signals is programmed by the SCP, and is dependent upon the depth of field to which the image is set.

The STG has two networks which generate the mixer phase and transmit delay clocks.

The STG is controlled by firmware on the SCP via the P bus. Control words are buffered and latched by logic on the STG.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

See the Scanner Troubleshooting section.

TDI — Transducer Interconnect Board

P/N:	TDI 1	10962T (Single DL)
	TDI 1	14962T (Dual DL)
	TDI 2	16312T (Dual DL)
	TDI 2	16982T (Single DL)
	TDI 3	22642T (Dual DL)
Ejector Tab Color:	N/A	
Quantity:	1	
Power Supplies:	-15V, +5V	
Buses:	N/A	
Signals In:	128 Receive/transmit channels; transducer ID code.	
Signals Out:	128 Receive/transmit channels; transducer ID code.	

Revision Requirements

TDI 3 dual DL required for Transducer Switch.

TDI 3 dual DL Rev. XA ok for all systems.

TDI 3 requires DBR 2 Rev. J or higher.

TDI 2 dual DL required for CW Doppler systems.

TDI 2 dual DL Rev. A ok for all systems without Transducer Switch.

TDI 1 dual DL Rev. 1 ok for non-CW Doppler systems.

Function

The Transducer Interconnect board is located along the front side of the Scanner card cage. The function of the TDI is to carry electrical signals to and from the transducer to the Scanner motherboard. DL-type connectors mounted on the TDI protrude through two openings at the front of the Acuson 128XP and provide interconnects for the transducer.

The TDI 3 allows two transducers to be connected simultaneously, but only one transducer port to be active at a time. Active port selection is under operator control using the Transducer Switch option. The TDI 3 contains a bank of 64 relays, each handling two ultrasound channels, that switch the transmit and receive channels back and forth between the left transducer port and the right transducer port. Refer to Figure 3-36 for a diagram of the signal path. The OC 3 reads the FPC 4 and reports to the SCP 3 (via the DBR 3), that the transducer ports need to be switched. The SCP 3 commands the TDI 3 to throw the relays to switch ports.

Troubleshooting

There is a minimal amount of circuitry on the TDI. Therefore, the most likely problem is damaged DL connectors. If the image displays single line dropouts that look like single receiver failures and has a corresponding transmitter failure, it is likely that the TDI is damaged. Also, if the system incorrectly reads the ID code of the transducer the TDI may be faulty.

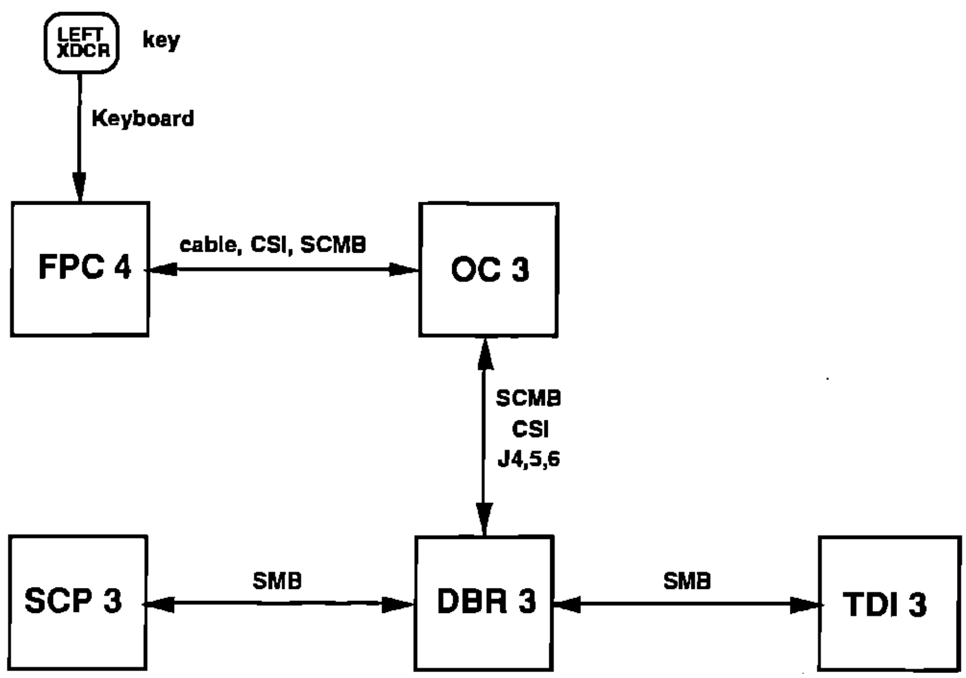


Figure 3-36. Transducer Port Switching

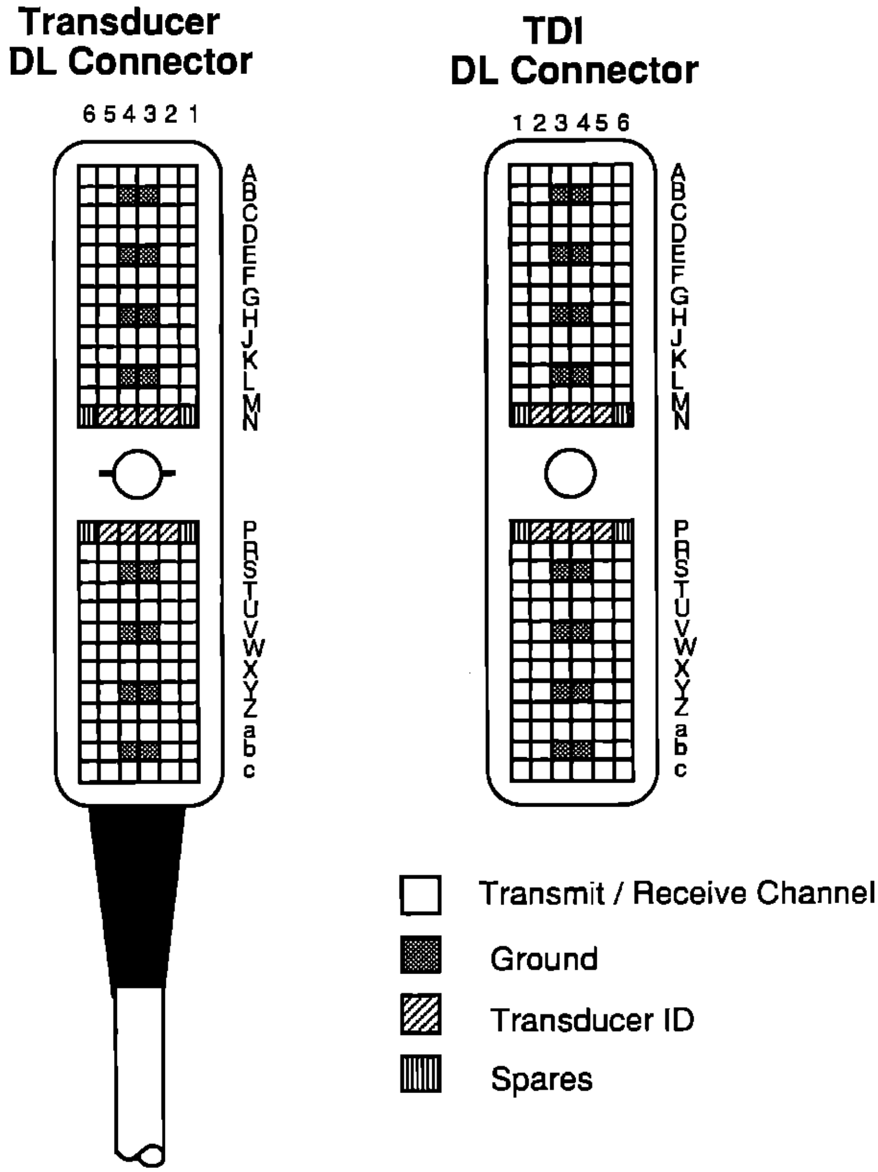


Figure 3-37. Transducer Interconnect Pins

DL Connector Pinout

	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
Row A	T/R 0	T/R 1	T/R 2	T/R 3	T/R 4	T/R 5
Row B	T/R 8	T/R 9	GND	GND	T/R 7	T/R 6
Row C	T/R 10	T/R 11	T/R 12	T/R 13	T/R 14	T/R 15
Row D	T/R 21	T/R 20	T/R 19	T/R 18	T/R 17	T/R 16
Row E	T/R 24	T/R 25	GND	GND	T/R 23	T/R 22
Row F	T/R 26	T/R 27	T/R 28	T/R 29	T/R 30	T/R 31
Row G	T/R 32	T/R 33	T/R 34	T/R 35	T/R 36	T/R 37
Row H	T/R 40	T/R 41	GND	GND	T/R 39	T/R 38
Row J	T/R 42	T/R 43	T/R 44	T/R 45	T/R 46	T/R 47
Row K	T/R 48	T/R 49	T/R 50	T/R 51	T/R 52	T/R 53
Row L	T/R 56	T/R 57	GND	GND	T/R 55	T/R 54
Row M	T/R 58	T/R 59	T/R 60	T/R 61	T/R 62	T/R 63
Row N	Spare	ID	ID	ID	ID	Spare
Row P	Spare	ID	ID	ID	ID	Spare
Row R	T/R 64	T/R 65	T/R 66	T/R 67	T/R 68	T/R 69
Row S	T/R 73	T/R 72	GND	GND	T/R 71	T/R 70
Row T	T/R 74	T/R 75	T/R 76	T/R 77	T/R 78	T/R 79
Row U	T/R 80	T/R 81	T/R 82	T/R 83	T/R 84	T/R 85
Row V	T/R 89	T/R 88	GND	GND	T/R 87	T/R 86
Row W	T/R 90	T/R 91	T/R 92	T/R 93	T/R 94	T/R 95
Row X	T/R 96	T/R 97	T/R 98	T/R 99	T/R 100	T/R 101
Row Y	T/R 105	T/R 104	GND	GND	T/R 103	T/R 102
Row Z	T/R 106	T/R 107	T/R 108	T/R 109	T/R 110	T/R 111
Row a	T/R 112	T/R 113	T/R 114	T/R 115	T/R 116	T/R 117
Row b	T/R 121	T/R 120	GND	GND	T/R 119	T/R 118
Row c	T/R 122	T/R 123	T/R 124	T/R 125	T/R 126	T/R 127

TRM Terminator Board

P/N:	10412T
Ejector Tab Color:	Red
Quantity:	1
Power Supplies:	+5V
Buses:	B, C, XDY, MXK
Signals In:	N/A
Signals Out:	N/A

Revision Requirements

TRM Rev. 2 ok for all systems.

Function

The Terminator board is used to terminate the B and C bus and also terminate the mixer phase and transmit phase buses, all of which are digital buses.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Since it is mostly a passive board with relatively few components, it is very unlikely that the Terminator board will fail. If symptoms resembling digital control problems develop and troubleshooting the SCP, DBR, DCC's, MEX and STG is unsuccessful, the next step is to swap the Terminator board and retest the system.

VDT — Video Detector Board

P/N:	VDT (radiology viewing)	17542T
	VDT (cardiology viewing)	18352T
	VDT 2	19982T
Ejector Tab Color:	Green	
Quantity:	1	
Power Supplies:	+15V, -15V, +5V	
Buses:	D	
Signals In:	IF SUM; VID Gain;	
Signals Out:	US VID	

Revision Requirements

VDT 2 required for 5.0 MHz cardiac transducers and all 7.0 MHz transducers.

VDT 2 Rev. A ok for all systems.

VDT P/N 17542T Rev. B used in all but CW Doppler systems.*

VDT P/N 18352T Rev. A used in CW Doppler systems only*.

*17542T Rev. C and 18352T Rev. B are interchangeable by configuring jumpers W1-W10. The jumpers optimize for the edge enhancement of the system for mainly radiology or cardiology viewing. Refer to System Switch Configurations in Section 2 for proper jumper settings.

Function

The Video Detector is used to process the summed ultrasound IF signal and convert it to an A-mode ultrasound video signal. Signal processing functions such as bandwidth control and preprocessing are also performed on the Video Detector.

The Video Detector is also equipped with circuitry to measure the phase of the test signal during the system's AUTO CAL cycle.

The Video Detector is controlled by microcode on the DCC -1 via the D bus. Logic on the Video Detector buffers and latches control words from the D bus to configure the Video Detector for a particular set-up format.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Visual Symptoms

If the Video Detector fails, the three most common visual symptoms are:

- No image
- Low gain
- Noise in the image

If any of these symptoms appear, and the power supplies are ok, replace the Video Detector and retest the system.

XDY — Transmit Delay Board

P/N	XDY 2	12952T
	XDY 3	16942T
Ejector Tab Color:	White	
Quantity:	8	
Power Supplies:	+5 V	
Buses:	XDY# 0, 1, 6, 7: B bus	
	XDY# 2, 3, 4, 5: C bus	
Signals In:	N/A	
Signals Out:	NX00 - NX15	

Revision Requirements

XDY 3 required for CW Doppler.

XDY 3 Rev. 1 ok for all systems.

XDY 2 Rev. 2 ok for all but CW Doppler.

(XDY 2 and XDY 3 boards may not be mixed in the same system.)

XDY 1 no longer supported.

Function

The two versions of Transmit Delay boards are electrically different but functionally equivalent. The Transmit Delay board contains 16 individual Transmit Delay channels. The output of each channel is used to drive the input section of each associated Transmitter channel which is carried via lines NX00 through NX15. Each channel has the function of processing the amount of delay needed to properly phase the transmit signal for any particular ultrasound line. The Transmit Delay board also outputs the selected number of transmit pulses required to aid in the power delivered from the transducer during the transmit cycle.

The Transmit Delay boards are controlled by microcode on DCC-0 or DCC-1, depending on the boards location. The information is carried over the B or C bus. DCC-0 and the B bus control Transmit Delay board 0, 1, 6 and 7. DCC-1 and the C bus control Transmit Delay boards 2, 3, 4 and 5. Logic on the Transmit Delay board buffers and latches control words from the B or C bus to configure the Transmit Delay board for a particular ultrasound line. Addresses for the Transmit Delay boards are encoded into the motherboard connectors to identify each of the eight XDY boards in the Scanner.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

Visual Symptoms

With an L382 transducer, a dark dropout zone appears at the top of the image, approximately 1 cm wide. The appearance will look exactly like that of a dead Transmitter board, since the XDY is used to drive the Transmitter board. Troubleshoot this type of problem as a Transmitter failure and if swapping the Transmitter board associated with the problem area has no effect on the symptom, swap the associated XDY board. Note that the scale at the top of the image can be used to associated the problem area with the faulty XDY board. The first centimeter corresponds to XDY-0.

XMT — Transmitter Board

P/N:	XMT 1	10502T
	XMT 2	13232T
	XMT 3	14002T
	XMT 4	20992T
Ejector Tab Color:	Green	
Quantity:	8	
Power Supplies:	+15V, -15V, +5V, 150V	
Buses:	A	
Signals In:	VXMT FROM IGD (or SGD); Delay from XDY (NX00-NX15)	
Signals Out:	XMT pulse to transducer (16 channels)	

Revision Requirements

XMT 4 required for S7146 transducer operation.*

XMT 4 Rev. XA ok for all systems.*

XMT 3 required for CW Doppler.

XMT 3 Rev. 3 ok for all systems without S7146.

XMT 2 required for pulsed Doppler.

XMT 2 Rev. 4 ok for all systems but CW Doppler and S7146 operation.

XMT 1 Rev. 1 ok for B/W non-Doppler systems.

*Note: XMT 4 may not be mixed with any other version of XMT board.

Function

The function of the Transmitter is to produce a negative polarity, high energy pulse burst to drive the transducer elements and produce an ultrasound wave. Each transmitter board contains 16 individual transmitter channels. The output of each channel is connected to one transducer element via lines T/R 0 - 15. Lines T/R 0 - 15 are also connected to the input of the Receiver channels. The pulses which drive the Transmitter are generated on the Transmit Delay board.

The output amplitude of all 128 Transmitter channels is controlled by the Scanner Gain Driver via line VXMT.

The Transmitter boards are controlled by DCC-0 via the A bus. Logic on the Transmitter board buffers and latches control words from the A bus to configure the Transmitters for a particular ultrasound line. Addresses for the Transmitter boards are encoded into the connectors in the motherboard to identify each of the eight Transmitter boards in the Scanner.

There are four versions of the Transmitter board, but they are functionally equivalent. There are eight Transmitter boards in the Scanner and 16 Transmitter Channels on each Transmitter board, providing a total of 128 Transmitter Channels in the Scanner.

Troubleshooting

The XMT boards may all shut down because of the loss of VXMT signal from the IGD 2 sensing excessive thermal conditions, or a defective IGD 2 .

Measurable Symptoms

Measure the output of the Transmitter channels at the DL connector with an oscilloscope as follows:

- Set the oscilloscope for 5 V/Div and the time base to 0.5 µS/Div. Terminate the oscilloscope probe into 50Ω.
- Ground the probe to the grounding block located below the DL connector on the Acuson 128XP.

CAUTION: The DL connector pins are fragile. Use appropriate care when performing this measurement.

- Carefully measure the DL connector pin that corresponds to the transmit channel of interest. A description and illustration of the DL connector pinout is provided in the TDI board section. See Figure 3-36.
- Note a burst of negative polarity square waves. Each burst consists of two to four pulses. The amplitude of the burst changes rapidly as the transmit channel is configured for each ultrasound line.
- Adjust the transmitter power by pressing XMTR POWER on the keyboard. Verify that the overall amplitude of the wave changes each time the key is pressed.

WARNING!! Do not remove or install a PCB with the power on.

- Verify that waveform of each transmitter channel is similar to the the other channels. If any channels are not functional, replace the XMT board that corresponds to the faulty channel. See Figure 3-5 for circuit board locations.

NOTE: Failures of the XDY board will cause symptoms similar to a XMT board failure. Replace the corresponding XDY if the channel does not function after replacing the XMT board.

Figure 3-38 illustrates a typical Transmitter output, L382 format, with the power at 0 dB and the oscilloscope terminated into 50Ω.

Visual Symptoms

With a linear format transducer connected to the system, identify faulty Transmitter boards by noting the location of the image artifact. There are 8 Transmitter boards numbered 0-7 in the Acuson 128XP. Therefore, each Transmitter corresponds to 1/8 of the image. Use the horizontal graticule to divide the image into eight equal segments and note which segment contains the artifact. The faulty Transmitter is in the corresponding Scanner XMT slot.

For example, with an L382 connected to the system, the horizontal graticule is 8.2 cm wide. Dividing 8.2 cm by eight Transmitter boards results in just over 1 cm per Transmitter board. Figure 3-39 shows a failure of the Transmitter board in slot XMT 1. Note that the dropout area is in the second 1 cm segment on the horizontal graticule. (The XMT slots are labeled 0-7).

When using sector, curved, or Vector Array transducers, locate failures of Transmitter boards by swapping the positions of any two of the Transmitter boards. Look for a change in the image. Continue to swap pairs of Transmitter boards until the image artifact moves. Once the defect is isolated to a pair of Transmitter boards, replace each board in turn to correct the problem.

The following images illustrate typical failures of the Transmitter board.

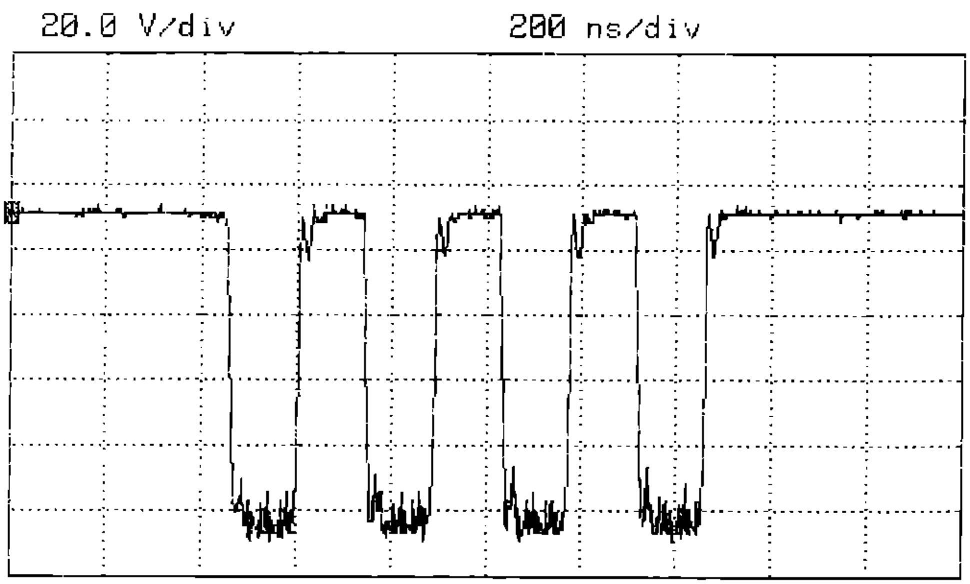


Figure 3-38. Transmitter — Typical Output Signal

A typical Transmitter output, L382 format, with the power at 0 db.

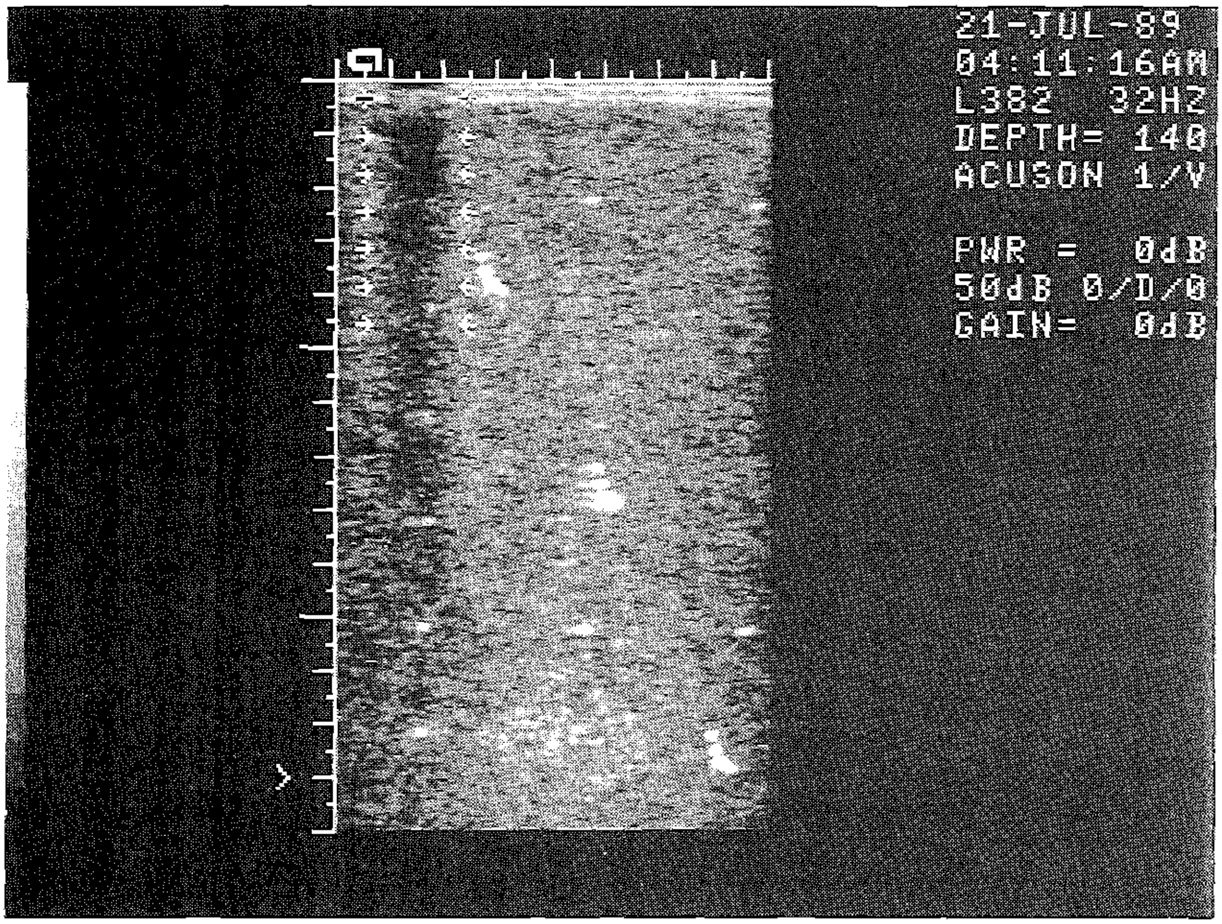


Figure 3-39. Transmitter — Complete Failure of Board in Slot XMT-1

With an L382 transducer attached, a dark zone approximately 1 cm wide appears running the length of the image. This zone is not completely black, but appears to have echo information at a very low level. The ringdown zone is missing at the location of the dead Transmitter board.

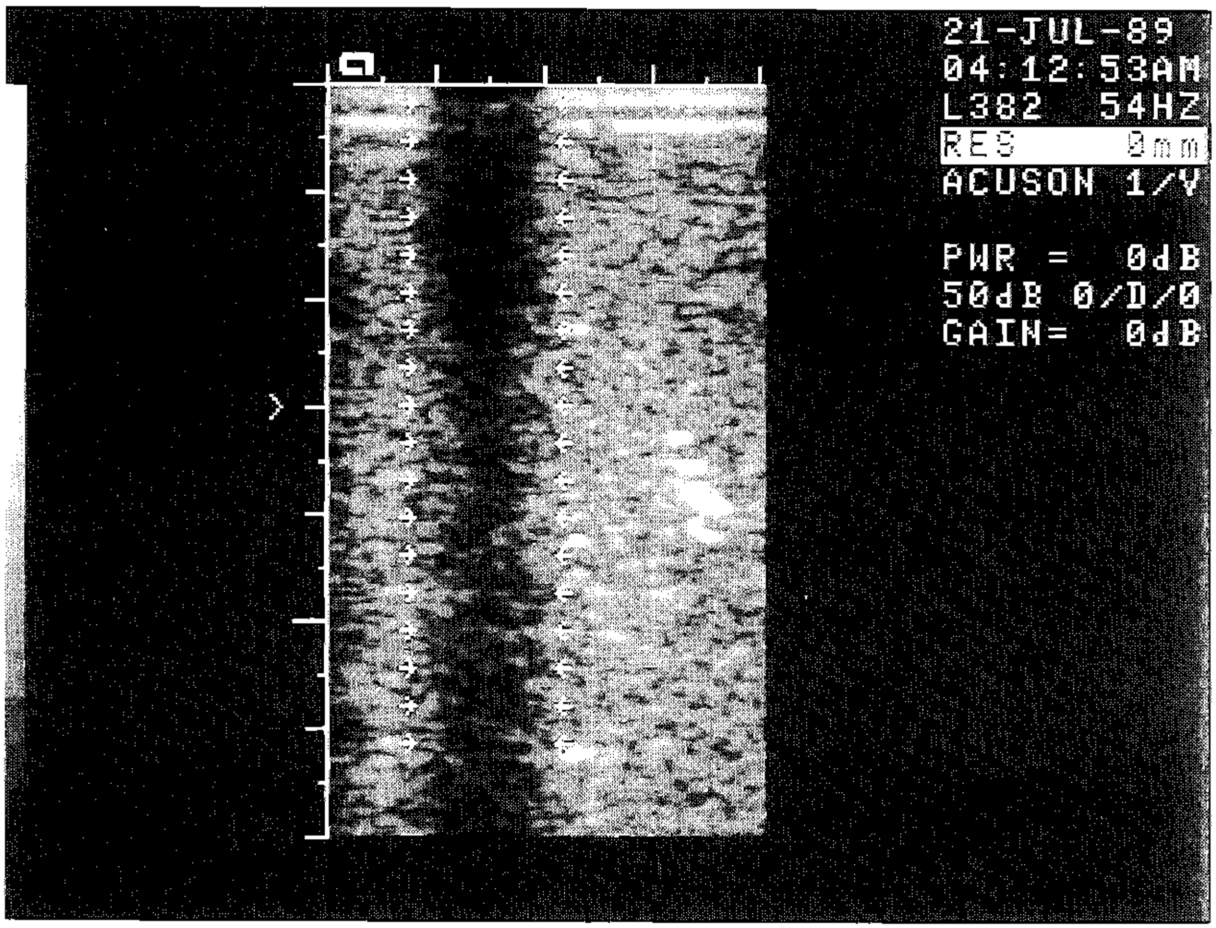


Figure 3-40. Transmitter — Board Failure with RES.

RES can be used to inspect the dropout zone. Note that the ringdown area at the failed transmit channel is not present.

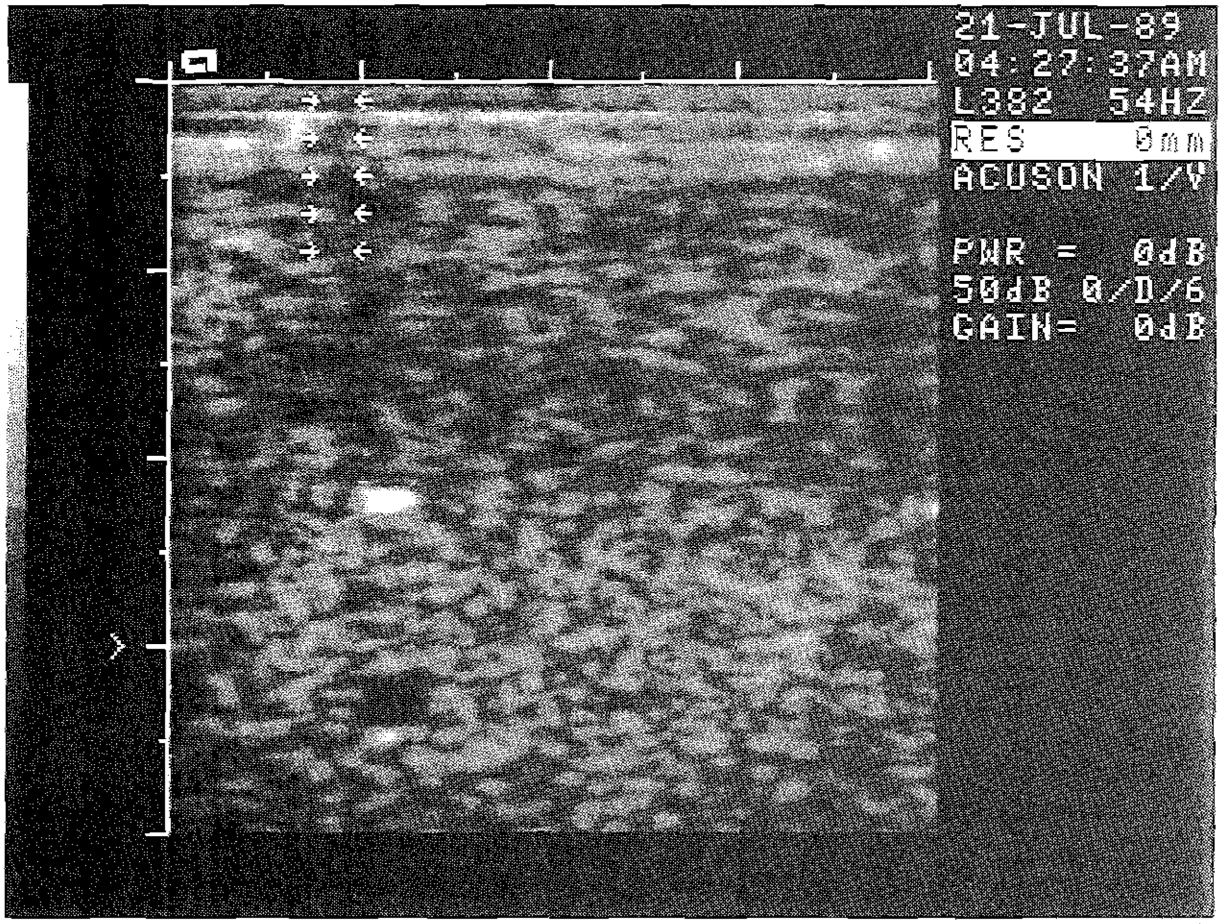


Figure 3-41. Transmitter — Single Channel Failure.

It is very difficult to detect a single dead Transmitter channel by inspecting the image. If you suspect a faulty channel, verify the operation of each Transmitter channel by measuring its output with an oscilloscope at the DL connector.

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Scan Converter

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Scan Converter Architecture

Overview

The Scan Converter assembly derives its name from one of its primary functions, namely to convert the scan format of data received from the Scanner. Ultrasound data can be obtained in one of four formats, linear, sector, curved or Vector Array. Neither of these formats is similar to the video raster format, therefore a conversion process must take place in order to display the ultrasound data on a video monitor.

In addition to this, the Scan Converter incorporates a number of other functions. These are to process ultrasound 2-D and Doppler data, to perform calculations and to interface the system to various input and output devices including the user controls. Overall control of the system is the job of a processor located on the Output Controller in the Scan Converter.

Listed below are the functions that can be performed by the Scan Converter. These are grouped together according to the capability they give the system. The circuit boards that perform the function are also shown.

Basic System

The Scan Converter, as shown in functional block diagram form in Figure 4-1, performs the following major functions for normal 2-D imaging:

- Overall control of the Acuson 128XP
- Digitization of the analog ultrasound video
- Conversion of ultrasound scan format to video scan format
- Video image storage
- Image enhancement and postprocessing
- Conversion to RS-170 video
- Alphanumeric and graphic overlays
- Interface to operator (front panel controls)
- Interface to recording devices (strip chart recorder, camera, VCR)

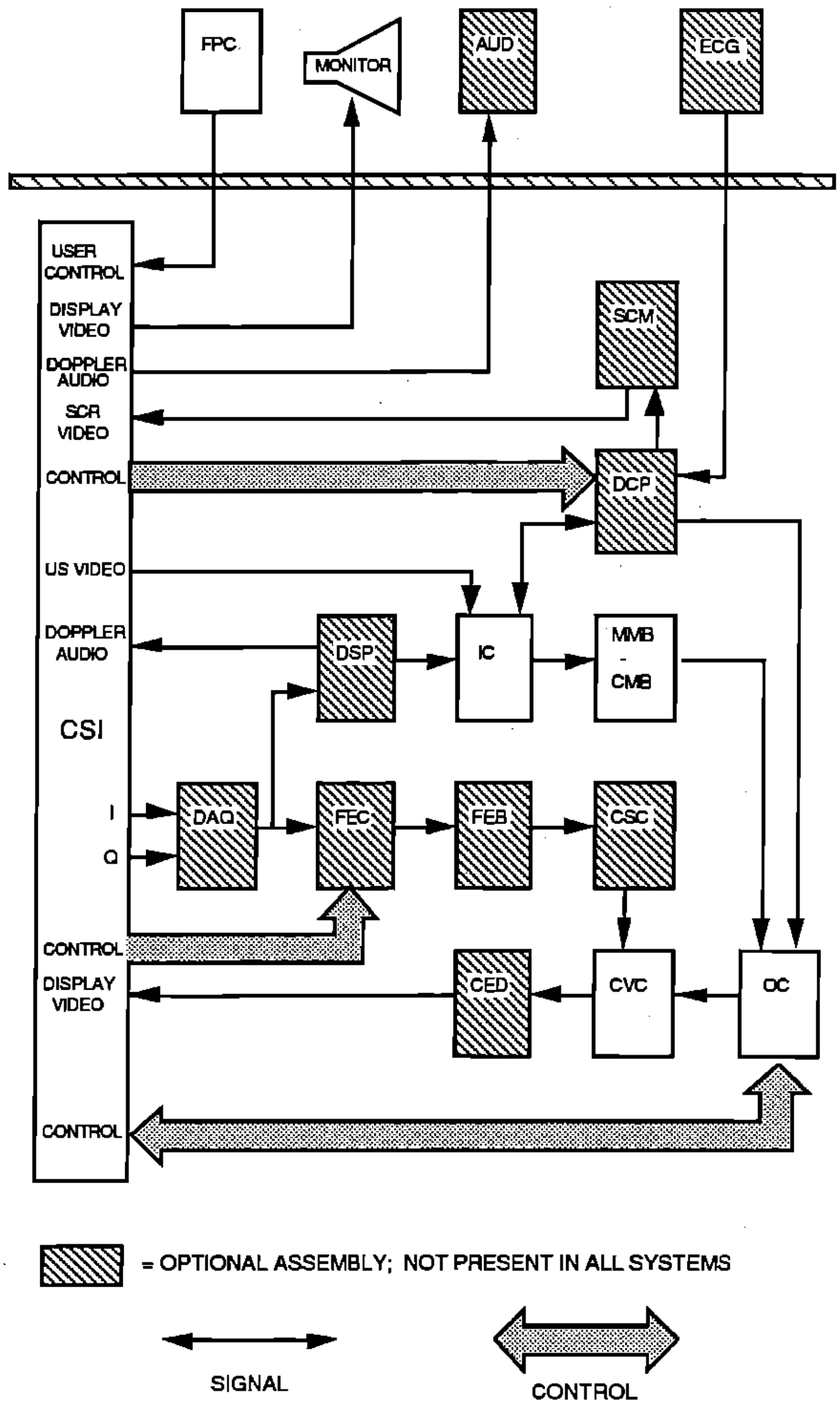

Figure 4-1. Scan Converter Block Diagram

Analog ultrasound video information is sent to the Scan Converter from the Scanner one scan line at a time. In the Scan Converter, the information is mapped into the proper memory locations of the image memory. From the image memory, the information is read out, converted to an analog signal, and mixed with graphic and sync signals for a composite video signal. The Scan Converter is organized into five functional areas, each occupying a single PC board:

- Input Controller (IC)
- Main Memory board (MMB)
- Output Controller (OC)
- Common Video Controller (CVC) or Video Controller (VC)
- Front Panel Controller (FPC)

Other functions are supported by the addition of the appropriate circuit boards.

Spectral Doppler

Processing Doppler data requires that additional functions be supported by the Scan Converter. Each of these functions represent a major functional group and each is supported by a particular circuit board:

- Digitize the I and Q signals that were passed from the BBQ. This is performed by the Doppler Acquisition board (DAQ).
- Perform algorithms to extract frequency data. This is performed by the Doppler Spectral Processor (DSP).
- Generate graphics unique to Doppler screen format. This is performed by the Display Control Processor (DCP).
- Generate an audio signal based on the I and Q data. This is performed by the Audio Processor (AUD).

Color Doppler

Color Doppler requires that additional processing functions be supported by the Scan Converter. Each of these functions represent a major functional group and is supported by a particular circuit board. Color Doppler capability cannot be added to a non-common cart Scan Converter

- Estimation of velocity for each color pixel. This is performed by the Flow Estimator Calculator (FEC).
- Storage of color image data. This is performed by the Flow Estimator Buffer (FEB).
- Output of data in sync with the video raster. This is performed by the Color Scan Converter (CSC).
- The color video signal requires additional processing to convert between RGB and composite video format. This is performed by the Color Encoder / Decoder (CED)

Strip Chart Recorder

Output to an external strip chart recorder requires special interface and control circuitry. These functions are supported by the addition of the:

- Strip Chart / M-mode board (SCM)

Cine

The Cine Option stores the most recently acquired image and strip data and allows playback of those frames at reduced speed. To support this function the Main Memory board (MMB) is replaced by the:

- Cine Memory board (CMB)

Additional boards in the Scan Converter are the Scan Converter Motherboard (SCMB), similar to the one used in the Scanner. The System Interconnect Board (SI) provides the connectors and electronics to interface the Scan Converter with the rest of the system. The Common System Interconnect Board (CSI) replaces the SI in those systems with a common upper cart (expanded version of the SCMB needed to accommodate the additional printed circuit boards required by color Doppler).

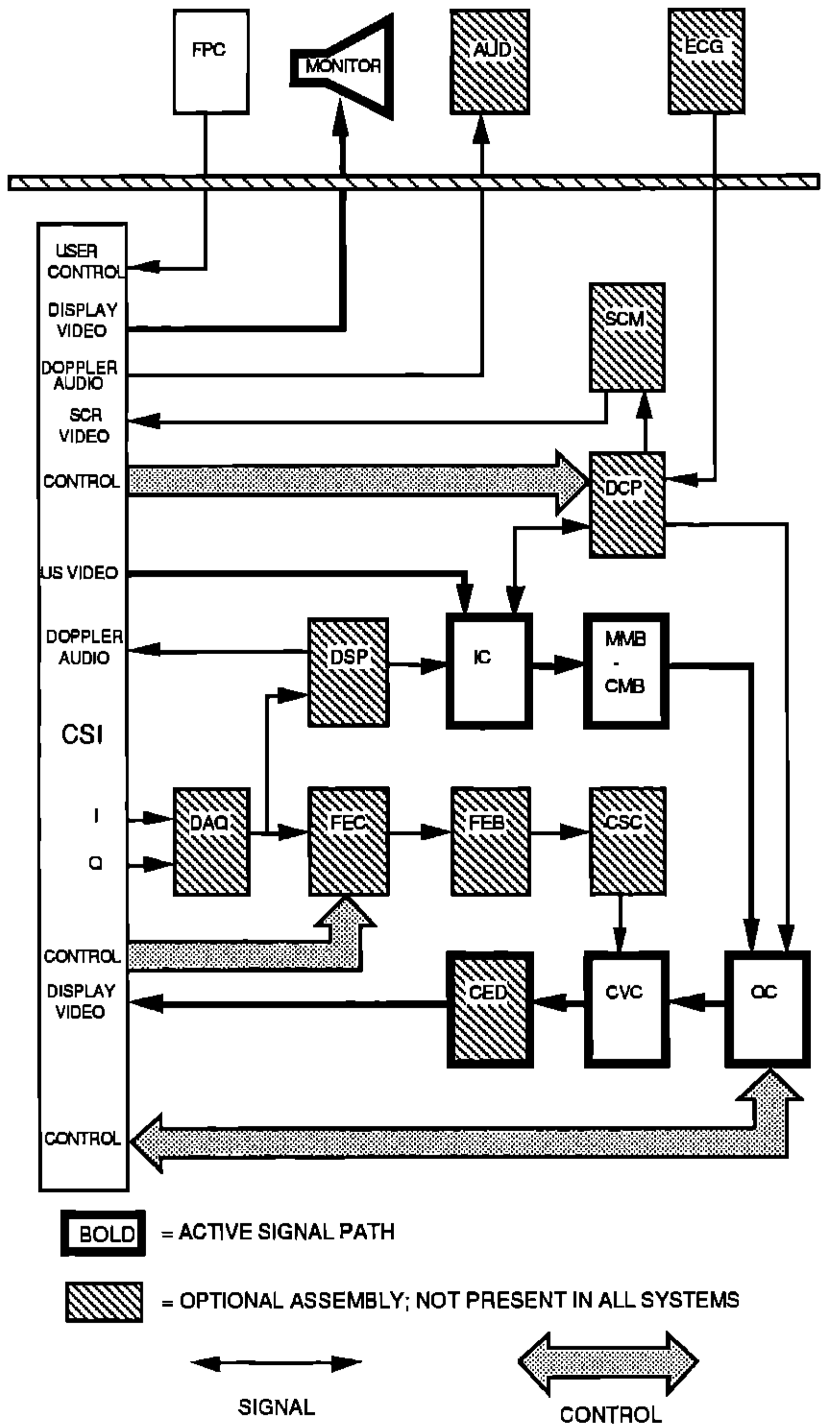

Figure 4-2. 2-D Imaging Signal Path

Scan Converter 2-D Operation

Scan Converter operations are controlled primarily by a microprocessor located on the Output Controller Board. Scan Converter architecture is shown in the block diagram in Figure 4-2.

Ultrasound line reception begins when the Scanner fires an ultrasound line and issues a start of line signal (SOL) to the Input Controller on the Scanner interface bus. The analog ultrasound signal is received at the Input Controller and digitized to binary values representing instantaneous values on the analog ultrasound line. The binary values are then routed to the Main Memory Board to be stored in the image memory. The Input Controller calculates the correct storage locations within the Main Memory Board for each word of ultrasound line data.

When the persistence feature is used the ultrasound bytes are manipulated within the Main Memory Board to partially reflect the value of their corresponding bytes in the previous frame.

The ultrasound words stored in the Main Memory Board are read by the Output Controller in sync with the TV raster according to the format desired (linear, sector, curved or Vector Array).

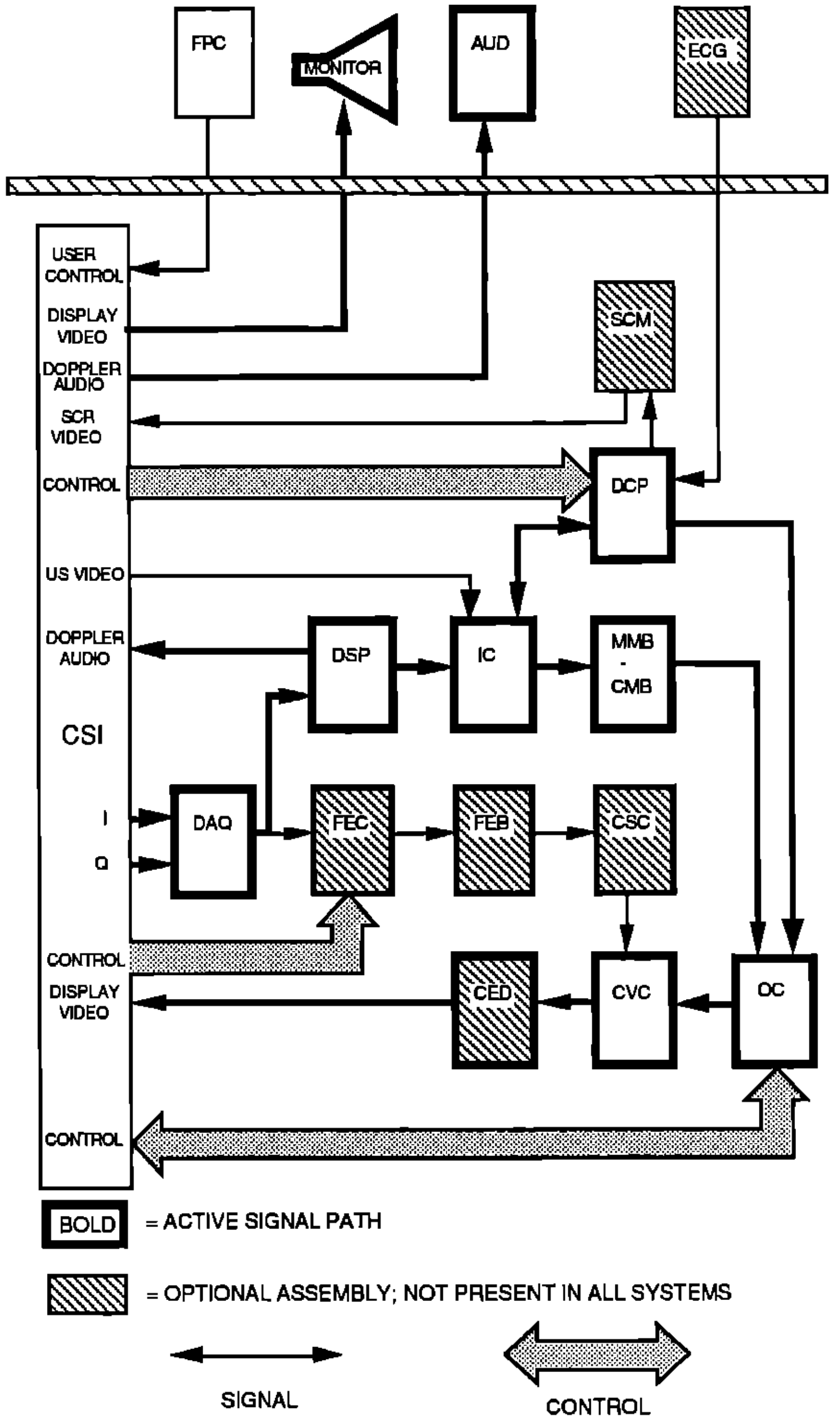

Figure 4-3. Spectral Doppler Signal Path.

Scan Converter Spectral Doppler Operation

The Scan Converter processes spectral data with the addition of the DAQ, DSP, DCP and AUD circuit boards. Refer to Figure 4-3 for a diagram of the signal path. The Scanner must also be equipped with a BBQ. If CW Doppler is required an AUX circuit board is also required in the Scanner.

When a Doppler line is fired by the Scanner, data regarding the line type is passed to the Scan Converter via the dual port RAM located on the DBR. The IF signal in the Scanner is processed by the BBQ, resulting in an I (in-phase) and Q (quadrature) signal. The I and Q signals are passed to the Doppler Acquisition board (DAQ) in the Scan Converter.

The DAQ digitizes the I and Q signals and passes the information to the Doppler Spectral Processor (DSP).

The DSP converts the I and Q time domain data into frequency domain or spectral data. The spectral data is then passed to the Input Controller (IC). The spectral data is now processed in a manner similar to 2-D image data. The digitized I and Q signals are also processed to audio frequencies and passed to the Audio Processor (AUD)for output through the speakers.

This spectral data that is passed to the Input Controller (IC) is processed by the same boards used to process the 2-D image data: the Main Memory board (MMB), Output Controller (OC) and Common Video Controller (CVC) or Video Controller (VC) .

The Display Control Processor (DCP) provides a number of support functions for Doppler displays. Most importantly, it controls the transfer of spectral Doppler data from the DSP to the IC. Additionally, the DCP provides graphics capabilities. These include generation of Doppler waveform displays, the erase bar and the scales and baseline of the spectral strip display.

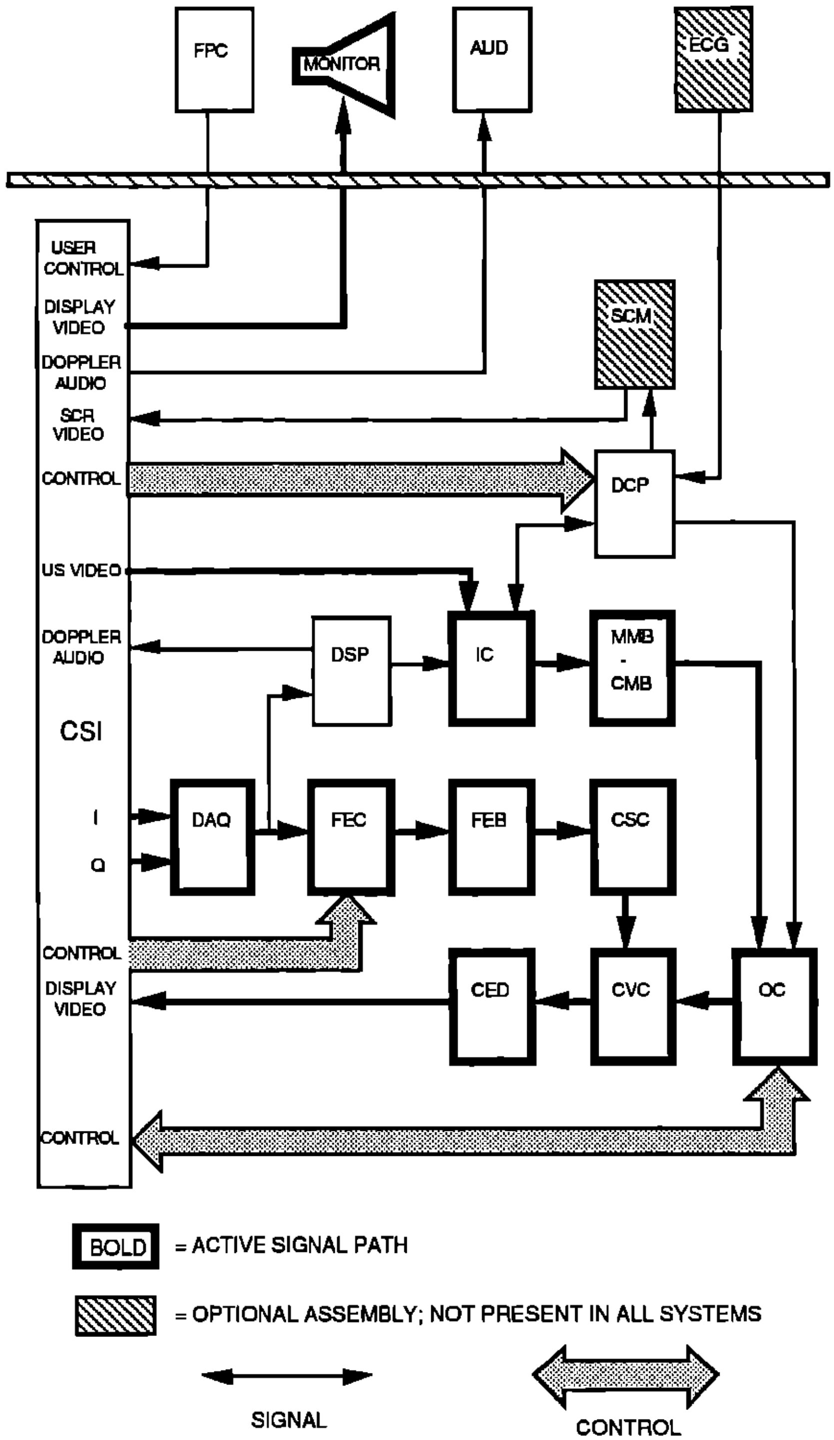

Figure 4-4. Color Doppler Signal Path

Scan Converter Color Doppler Operation

The Scan Converter is able to process color data with the addition of the FEC, FEB and CSC. See Figure 4-4 for a diagram of the signal path. As with spectral Doppler, the Scanner must be equipped with a BBQ.

When a Doppler line is fired by the Scanner, data regarding the line type is passed to the Scan Converter via the dual port RAM located on the DBR. The IF signal in the Scanner is processed by the BBQ, resulting in an I (in-phase) and Q (quadrature) signal. The I and Q signals are passed to the Doppler Acquisition board (DAQ) in the Scan Converter.

The DAQ digitizes the I and Q signals and provides initial filtering. The digitized I and Q signals are then passed to the Flow Estimator Calculator (FEC). The FEC extracts velocity and variance data from the I and Q signals. This data is then passed to the FEB.

The Flow Estimator Buffer (FEB) stores the velocity and variance data. The FEB also stores the most recently acquired frames of 2-D and M-mode color information for use in conjunction with Imaging and Strip Cine (requires CMB). This data is then passed to the CSC.

The Color Scan Converter (CSC) converts ultrasound line format into video raster format. This data is then passed to the Common Video Controller (CVC) where it is overlaid on the 2-D image.

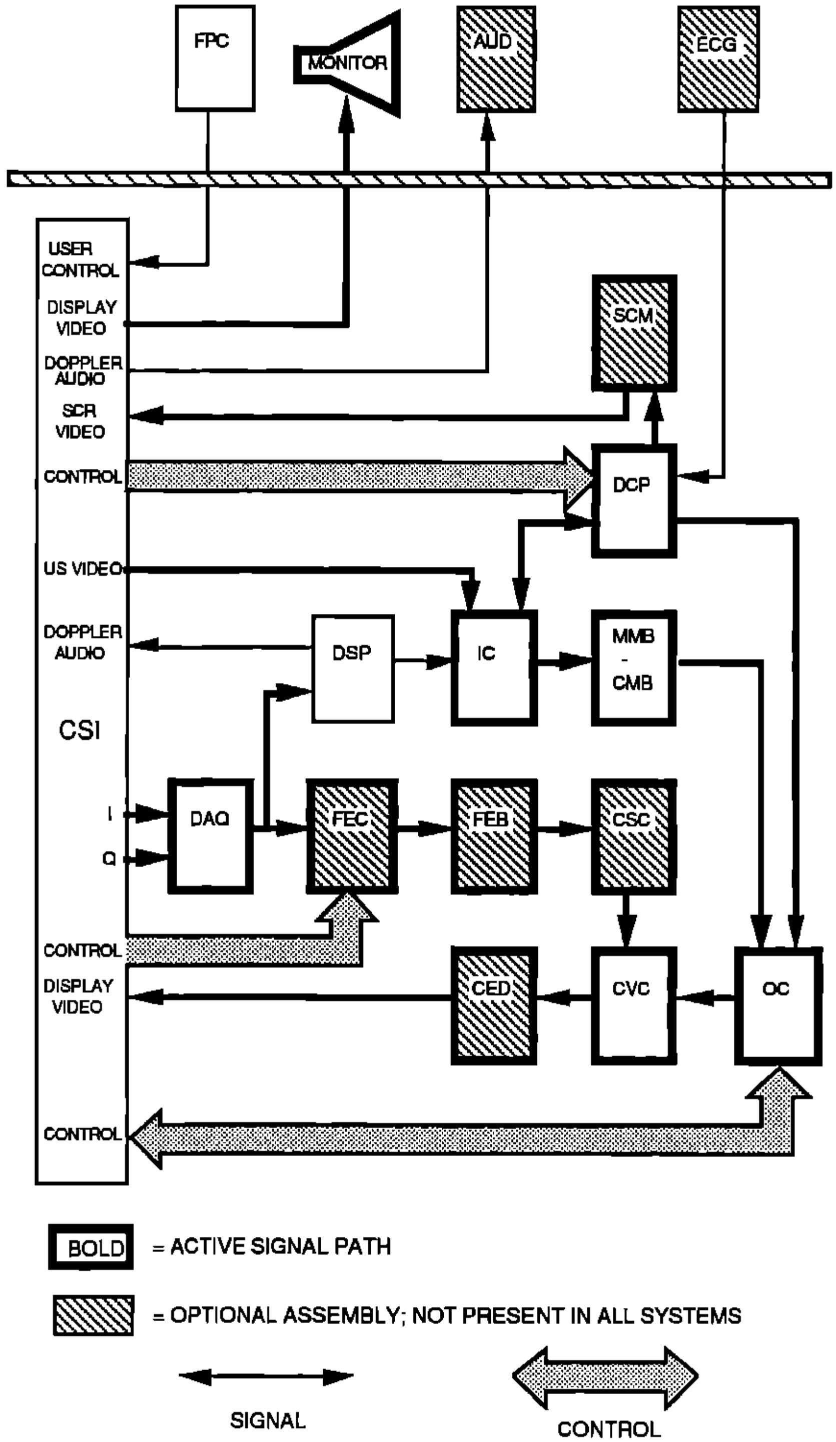

Figure 4-5. Cardiac M-mode Signal Path

Scan Converter Cardiac M-mode Operation

The Scan Converter is able to process Cardiac M-mode data with the addition of the DCP2 circuit board. If a strip chart recorder is used with the system, a SCM board will be installed to generate SCR video. Refer to Figure 4-5 for a diagram of the signal path.

The IC passes the ultrasound data to the DCP2 which generates M-mode strip data. The DCP2 passes the M-mode strip data to the MMB/CMB via the IC for display on the Acuson 128XP monitor and to the SCM for conversion to SCR video. The DCP2 also provides the M-mode strip graphics which are then passed directly to the CVC for display.

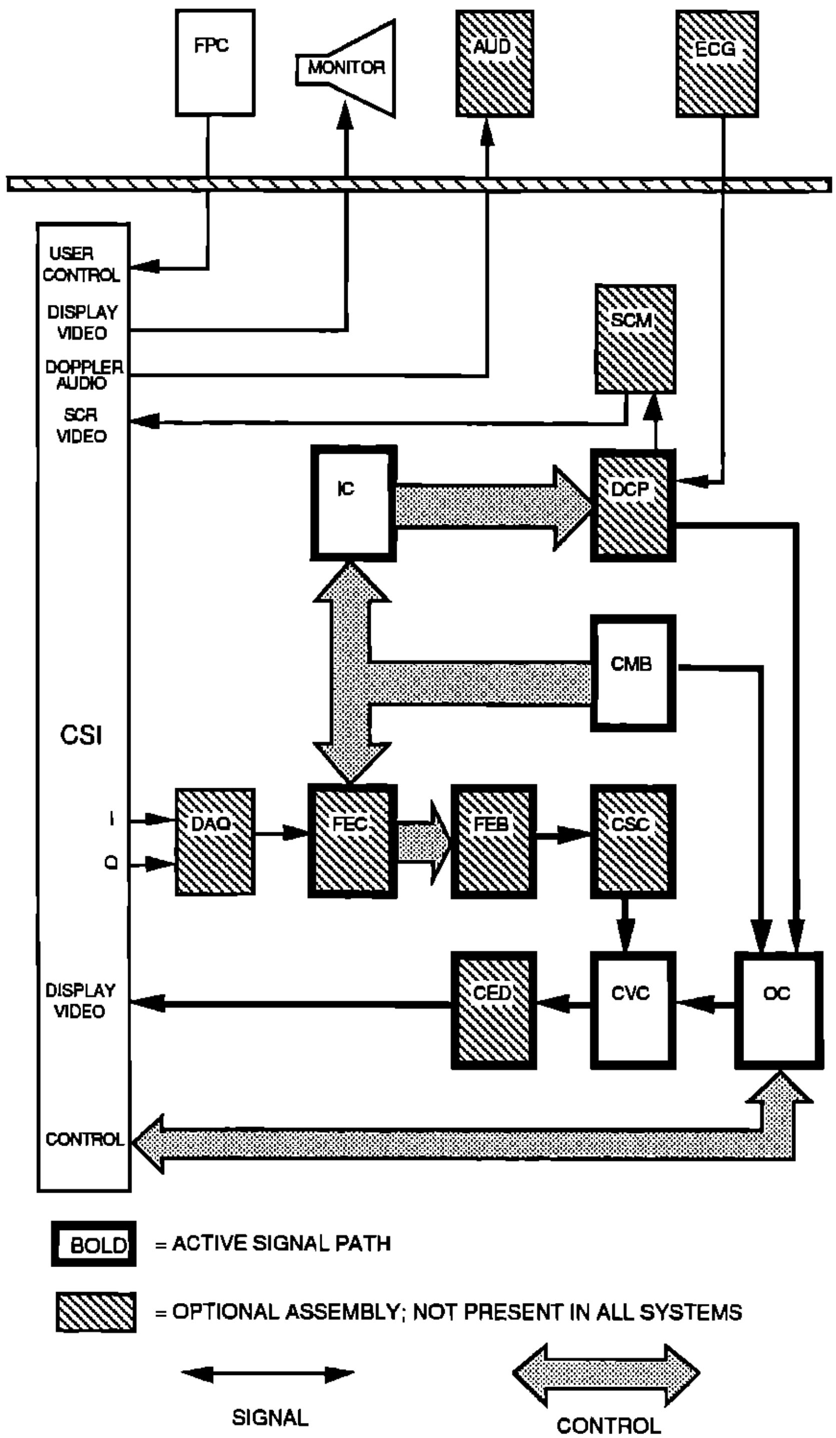

Figure 4-6. Cine Review Signal Path

Scan Converter Cine Operation

The Scan Converter acquires and allows playback of image and strip data (spectral Doppler and cardiac M-mode) with the addition of the CMB circuit board. Refer to Figure 4-6 for a diagram of the signal path.

The Scan Converter receives the analog ultrasound signal and the I and Q signals from the Scanner, as described earlier. The Cine RAM on the CMB stores the most recently acquired frames of gray scale image data, spectral Doppler data, and M-mode data, while the FEB stores frames of color Doppler and color M-mode. The DCP stores the physio traces and derived waveforms.

In Cine review, the CMB passes line type data to the IC and FEC to synchronize the gray scale data with the color data. The CMB also passes line type data to the DCP via the IC in order for the physio signals and pulsed Doppler derived waveforms to be displayed.

The CVC combines and displays the color Doppler and the M-mode data from the CSC, the B/W 2-D, spectral Doppler and M-mode data from the CMB, and the physio traces and Pulsed Doppler derived waveforms from the DCP.

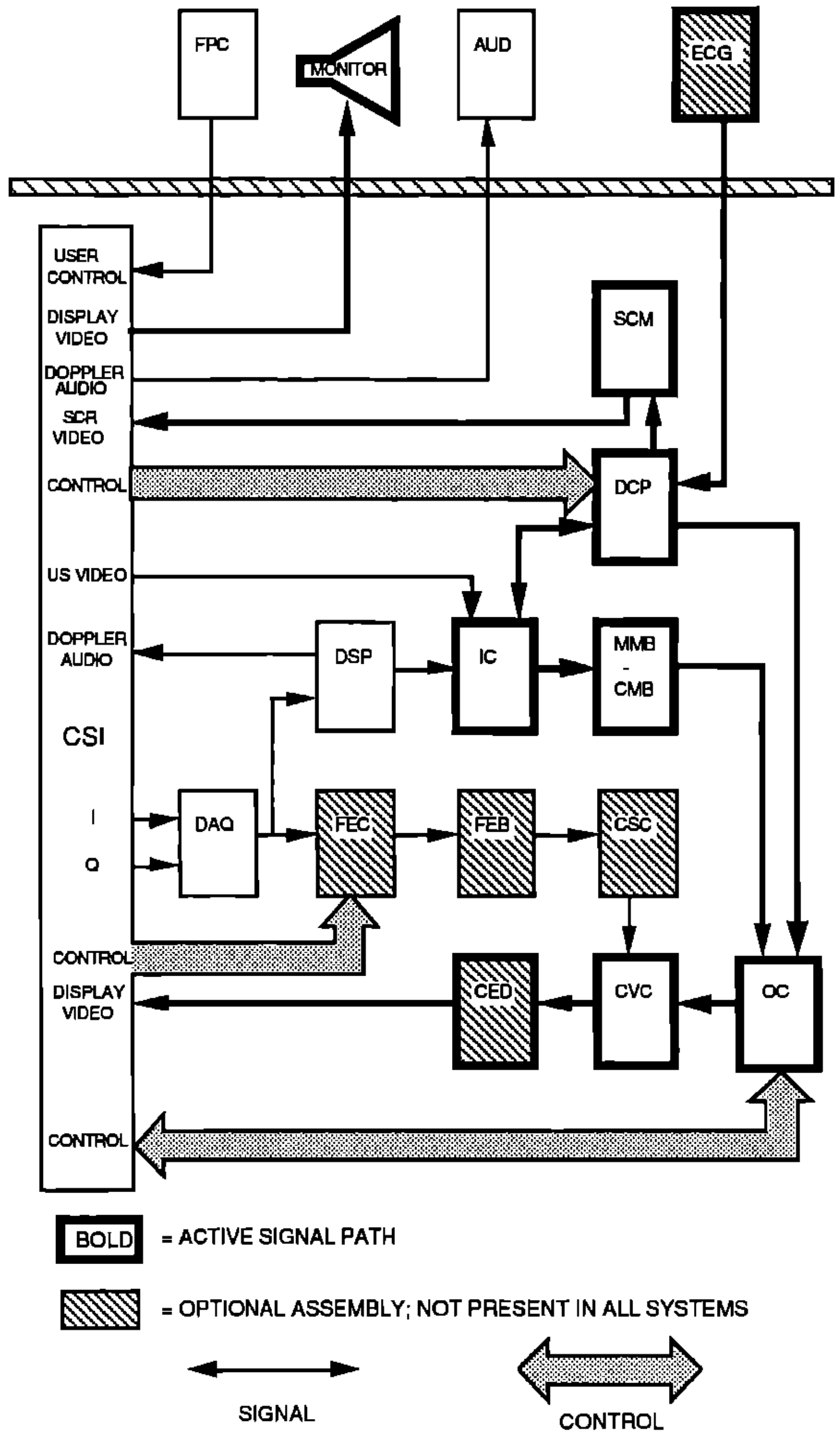

Figure 4-7. ECG/PHYSIO Signal Path

Physio Interface Signal Processing

The Physio Interface allows the ECG module to display an ECG and an auxiliary signal on the Acuson 128XP monitor, and the Physiologic module to display heartsound, pulse and respiration. These signals may be used to trigger the 2-D image update when using pulsed Doppler or M-mode or they may be used as a time base when reviewing the Cine memory.

CAUTION: The ECG and Physio module is not designed for use in conjunction with electrosurgery or diathermy equipment.

The ECG and Physio module mounts in the lower cart of the Acuson 128XP, just above the camera bay. Three cables are connected to the ECG module: the power cable P1, Physio Interface cable P2, and the phono jack P4. The power and Physio Interface cables also connect to the Physio module.

The power cable supplies +12 V and -12 V to the ECG and Physio module. These voltages are taken from the Scan Converter power supply.

The R-wave beeper signal is passed to the AUD circuit board via the phone jack on the ECG. The beeper may be routed to the speakers by the AUD board.

The Physio Interface cable contains the signal and status lines which are used by the Acuson 128XP. These signals include the ECG wave, auxiliary wave, heartsound, pulse, respiration, and trigger signals. The status lines include ECG channel on/off, auxiliary channel on/off, phono on/off, pulse on/off and phono mode. These signals are sent to the DCP and SCM circuit boards in the Scan Converter card cage.

The DCP uses the signals to reconstruct the waveforms on the 128XP monitor or to coordinate the 2-d image updates when in triggered mode.

The SCM board uses these signals to reconstruct the waveform on the strip chart recorder.

Scan Converter Troubleshooting

Failures of Scan Converter boards can result in power-up errors or incorrect system operation. The following is a general overview of Scan Converter troubleshooting. For greater detail turn to the section for the specific board.

Power-up Errors

When the system is powered on or reset, a series of diagnostic tests is performed on the Scan Converter circuitry. Although the resulting error messages indicate specific boards, the actual cause of failure may be a related board. The following table lists Scan Converter power-up messages and likely causes.

Power-up Message	Potential Causes
OC 3 Power-up Error	OC 3, MMB or CMB, IC 2, CVC or VC
IC 2 Power-up Error	IC 2, MMB or CMB, OC 3
MMB Power-up Error	MMB, OC 3, IC 2
CVC or VC Power-up Error	invalid characters on text screen 1 or text screen 2; CVC or VC, OC 3
CMB Power-up Error	CMB, OC 3, IC 2
DSP Power-up Error	DSP, DAQ, DCP
DAQ Power-up Error	DAQ, DSP, DCP
DCP Power-up Error	DCP, DAQ, DSP
FP Power-up Error	FP, OC 3
SCM Power-up Error	SCM, IC 2
FEC Power-up Error	FEC, FEB, CSC
FEB Power-up Error	FEC, FEB, CSC
CSC Power-up Error	FEC, FEB, CSC

Operational Problems

When troubleshooting operational problems of the Scan Converter, first identify the operating mode or modes where malfunction occurs. Once the failure is defined to a specific operating mode, only a few assemblies need to be checked to isolate the cause. The flowcharts in this section show the signal routing and the assemblies used in the all operating modes of the Acuson system.

Scan Converter Assemblies

The following circuit board descriptions are arranged alphabetically by the three letter acronym of each board. Each board has a troubleshooting section describing failures and offering solutions for board specific problems. See the Scan Converter Troubleshooting section for more information about problems in the Scan Converter.

Also note the "Revision Requirements" section for each circuit board. All Scan Converter circuit boards are backward compatible. Therefore, as you read the requirements for a board, remember that a higher version or revision of a board may be used in place of lower version or revision.

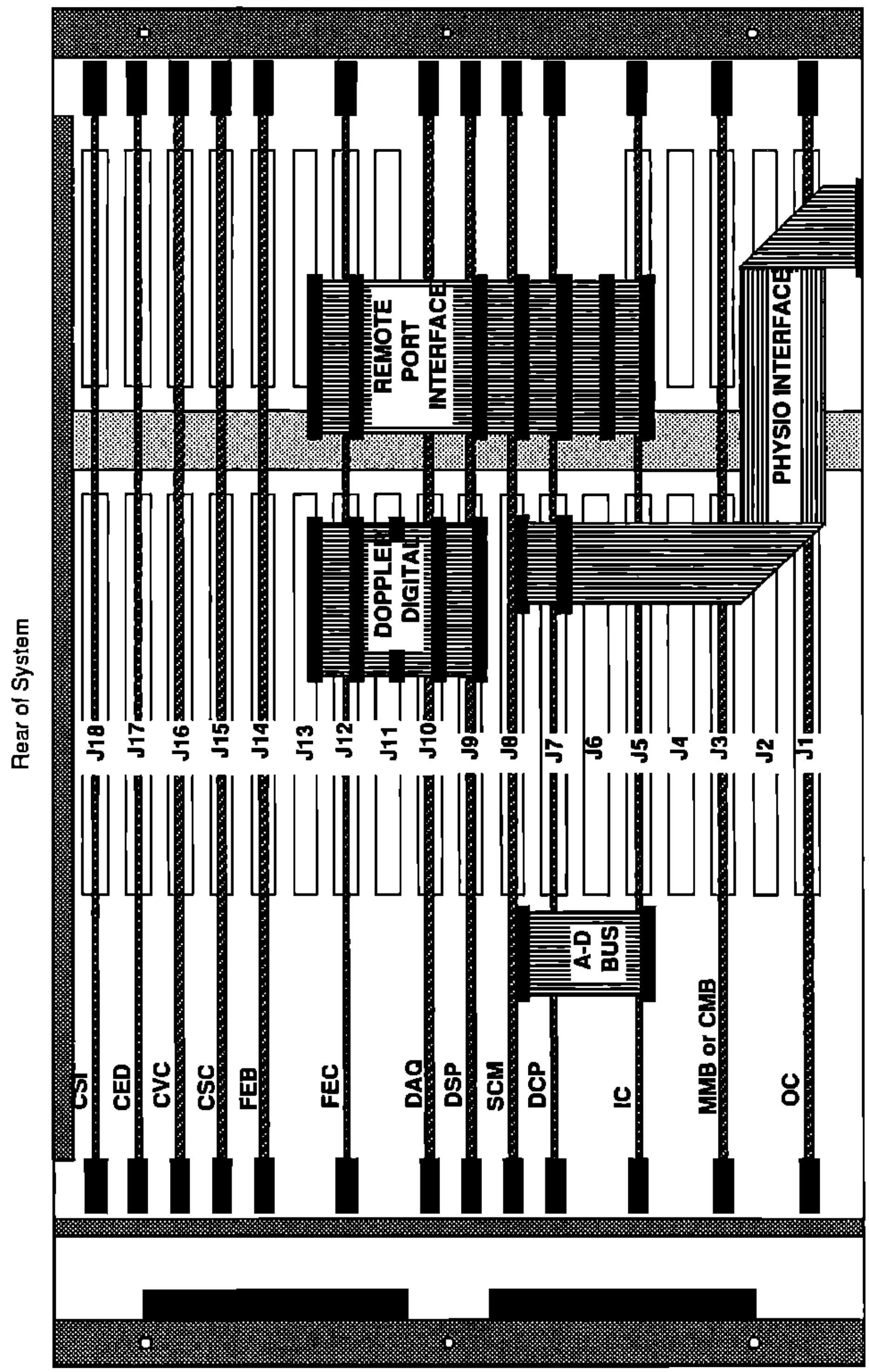

Figure 4-8. Scan Converter Motherboard Layout

AUD — Audio Processor Board

P/N:	AUD 1 14022T
	AUD 2 19422T
Quantity:	1
Power Supplies:	+12V, -12V
Buses:	N/A
Signals In:	I and Q signals from DSP
	VCR audio
	Beeper from ECG module
	Microphone audio
Signals Out:	Audio for speakers, headphones, VCR

Revision Requirements

AUD 2 Rev. A required use with universal monitor mounts.

AUD 1 Rev. 8 required for CW Doppler (non-universal monitor mounts).

AUD 1 Rev. 5 ok for other systems (non-universal monitor mounts)

Function

The Audio Processor performs two basic functions related to the handling of audio functions: generation of left and right audio based on the I and Q signals and the routing of audio signals based on the configuration of the system and control signals from the Output Controller.

Inputs available to the audio signal switching matrix include:

- Left / right audio generated from I and Q signals.
- VCR left and right audio.
- Beeper from ECG module.
- Onboard microphone.

These signals may be routed to the following outputs:

- Headphones left / right.
- Speakers left / right.
- VCR record left / right.

Troubleshooting

WARNING!! Do not remove or install a PCB with the power on.

The AUD board is located beneath the Scan Converter below the monitor. See Figure 6-2. The Audio Processor may be defective if one or more of the following problems is experienced:

Doppler audio missing.

If either or both of the Doppler audio channels is lost or distorted, the AUD or DSP may be at fault. Replace each board in turn to isolate the failure.

Audio signal not recording on the VCR.

Enter Doppler. Press TAPE. Verify that Doppler audio is heard on the Acuson 128XP speakers. Note the audio level meters on the VCR. If they do not move, verify proper connection of the VCR and integrity of the audio cables. If the problem persists, replace the AUD.

Audio signal not playing back from VCR.

Verify that an audio signal was recorded on the tape that is being played. Verify proper connection of the VCR and integrity of the audio cables. If the problem persists, replace the AUD.

CED — Color Encoder / Decoder Board

P/N:	CED 1 NTSC	17752T
	CED 1 PAL	17652T
Quantity:	1	
Power Supplies:	+12V, -12V, +5V	
Buses:	System control bus	
Signals In:	RGB video from CVC	
	Composite video from VCR	
	Component video from VCR	
Signals Out:	RGB video	
	Composite video	
	Component video	

Revision Requirements

CED 1 NTSC Rev. A required for Super VHS (NTSC video only).

CED 1 NTSC Rev. 15 ok for all NTSC video systems.

CED 1 PAL Rev C ok for all PAL video systems.

Function

The CED is used only in systems with Color Doppler. It performs the conversion between the Acuson 128XP video formats. The signal acquired from the CVC while imaging is an RGB format. The monitor in the Acuson 128XP uses an RGB format. However, external recording devices use a variety of different formats, including RGB, composite video and component video. The CED encodes the RGB signal into these various formats.

During playback from a VCR the composite or component video signal must be decoded to RGB video for use by the internal monitor. This is done by the CED.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

A defective CED may cause one of the following problems:

Video distorted on internal monitor.

If the internal video is distorted, but appears ok on external recording devices, the problem may be the CED or CSI. Replace each of these boards to isolate the failure.

Video distorted on external devices. (video ok on the internal monitor)

If the video is distorted on external recording devices, but appears ok on the monitor, the problem may be a faulty cable, the CED or CSI. Verify the integrity of the cables, then replace the CED and CSI boards to isolate the failure.

Video distorted on the monitor and on external devices.

If all video signals are distorted then the problem may be the CED or the CVC. Replace each of these boards to isolate the failure.

CMB — Cine Memory Board

P/N:	19152T
Quantity:	1
Power Supplies:	+5V
Buses:	Local Control Bus MMB Data Bus Video Image Bus
Signals In:	Digitized ultrasound data.
Signals Out:	Ultrasound data in sync with raster

Revision Requirements

CMB Rev. D ok for all systems with Cine Option.

Function

The CMB is required in systems that have the Imaging Cine and Strip Cine options. It replaces the MMB and performs all of the functions of the MMB. Like the MMB, the CMB is the RAM buffer for the digitized ultrasound video information. Its primary functions are to provide the buffer storage area necessary to perform time-base correction between the variable frame rate ultrasound scan and the fixed frame rate TV raster scan, and to perform scan conversion from the ultrasound scan format to the video raster format. Secondary functions include persistence generation and gray level mapping (postprocessing). In addition, the CMB continuously stores the most recently acquired B/W 2-D image data, spectral Doppler and M-mode strip data, which may then be reviewed by the user. To allow for maximum usage of available memory, the number of video frames stored varies according to the format of the system.

The Imaging Cine function is available with gray scale and Color Doppler Imaging. Strip Cine function is available with spectral Doppler, cardiac M-mode, and color cardiac M-mode. The CMB stores only the gray scale portion of the image. Color Doppler and color M-mode frames are stored on the FEB.

The CMB functions are:

- Storage of image data
- Time base correction
- Persistence
- Postprocessing
- Storage of the most recent gray scale image and strip data

CMB's in USA domestic systems which use NTSC video are constructed without RAM chips in some locations on the board. CMB's in international systems which use PAL video are fully populated with RAM's. Refer to System Switch Configurations in Section 2 for more information.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs, replace the board.

WARNING!! Do not remove or install a PCB with power on.

See the Scan Converter Troubleshooting section.

CSC — Color Scan Converter Board

P/N:	CSC 1	17202T
	CSC 2	20662T
Quantity:	1	
Power Supplies:	+5V	
Buses:	System control bus	
	Color data bus	
Signals In:	Flow parameters from FEB	
Signals Out:	Flow parameters synced with video	

Revision Requirements

CSC 1 Rev. 13 ok for all systems.

CSC 2 Rev. XA required for Strip Cine.

Function

The Color Scan Converter board, as the name implies, converts the format of the color data from the scan format to the video format used by the monitor. It is used in conjunction with the FEC and FEB. The CSC reads data from the FEB in sync with the video raster. This data is then passed to the CVC where it is overlaid on the 2-D ultrasound image.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

Problems with the CSC will generally appear in the following ways:

Noise

Noise in the color Doppler display will appear as colored pixels randomly appearing in the color RES box. It is normal to see a large number of these when the CD level knob is turned fully clockwise (transducer connected but not imaging anatomy). With the CD level knob turned about half way up, there should be significantly fewer pixels randomly lighting. With the CD level knob fully counter-clockwise there should be no colored pixels lighting.

Bogus color information

Artifacts such as color lines or color blocks appear.

No color Doppler signal

With the CD knob fully clockwise, no color signal or noise appears.

Positional errors of color pixels

Color data appears somewhere other than in the vein or artery or bogus information appears outside the color RES box.

The CSC is used for color Doppler processing only. This data path is separate from the spectral Doppler data path. Therefore, problems with the CSC will generally manifest themselves only in the color Doppler display. If any of these symptoms appear, check the spectral Doppler display for similar problems. Problems common to both may be caused by the BBQ, DAQ or power supplies. If the problem is only seen in color Doppler, try replacing the CSC, FEC or FEB.

CSI — Common System Interconnect Board

P/N:	CSI 1	17102T
	CSI 2	22172T
Quantity:	1	
Power Supplies:	+12V, -12V, +5V	
Buses:	System control bus	
Signals In:	*	
Signals Out:	*	

* All signals to or from the Scan Converter are passed through the CSI.

Revision Requirements

CSI 2 Rev. XA ok for all systems.*

CSI 1 Rev. A required for AUX CW in common cart systems.

CSI 1 Rev. 13 ok for all systems.

SI replaces CSI in non-common cart systems.

*Refer to System Switch Configurations in Section 2 for CSI 2/DBR 3/DBR 2 jumper settings.

Function

The CSI provides the interface between the Scan Converter, Scanner, Front Panel Controller and system recording devices. The CSI also provides signal buffering and address decoding logic for use by the system bus and dual port RAM. Video buffering (input and output) is provided for component and composite video formats. RGB output is also provided. In addition, all control lines for recording devices are driven from the CSI. Figure 2-4 provides a reference for the interconnections to the CSI.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

The Common System Interconnect board is located along the rear panel of the Scan Converter card cage. To remove the Common System Interconnect board from the Scan Converter, disconnect all of the coax and ribbon cables and remove the Scan Converter rear panel.

Because all of the signals between the Scanner and the Scan Converter flow through the CSI, power-up diagnostic errors such as "S.INTRPT" (which indicates a problem with interrupts from the Scanner) may be caused by a defective CSI board. See the Scan Converter Troubleshooting section.

CVC — Common Video Controller Board

P/N:	17182T
Quantity:	1
Power Supplies:	-12V, +12V, +5V
Buses:	System control bus
	Graphics data bus
	Video image bus
	Video sync bus
Signals In:	2-D image data from output controller
	Graphics data from OC, CSC and/or DCP
Signals Out:	Composite video signal
	RGB video signal

Revision Requirements

CVC Rev. F required for all systems.

Jumper requirements differ for color or B/W systems. Refer to System Switch Configurations in Section 2 for more information.

Function

The main function of the Common Video Controller is to receive digital signals from several buses, combine them and convert the signals to analog RS-170 (or PAL) video for display on a B/W CRT or RGB video for a color CRT.

Image data from the MMB is transferred to the Common Video Controller via the System Image Bus on the Scan Converter Motherboard. The Common Video Controller generates the required graphics and alphanumeric data to overlay on the ultrasound image through a combinational logic system. Joined with sync signals, the digital video signal is converted to a standard RS-170 analog composite video signal or to an RGB video signal by a D/A converter.

Three unrelated features of the Common Video Controller are the time-of-day clock, the battery-backed-up RAM and additional PROM sockets. The clock and RAM are backed by battery power when the system is not powered on. The RAM will maintain information and the clock will maintain accurate time after the power is removed. Additional PROM sockets within the output controller address space are used for program expansion.

The functions of the Common Video Controller are:

- Generation of graphics
- Generation of alphanumerics
- Overlay of graphics/alphanumerics/image data
- Video digital-to-analog conversion
- Time of day clock
- Battery-backed up RAM
- Prom sockets for operating software.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

Note: The battery-backed-up RAM stores all user programs as well as other parameters unique to your system. If replacement of this board is required, contact Acuson Technical Support for information regarding the configuration of your system

WARNING!! Do not remove or install a PCB with the power on.

See the Scan Converter Troubleshooting section.

DAQ — Doppler Acquisition Board

P/N:	DAQ 1	13332T
	DAQ 2	18552T
	DAQ 3	19312T
Quantity:	1	
Power Supplies:	+12V, -12V, +5V	
Buses:	System control bus	
	Doppler digital bus	
Signals In:	Analog I and Q signals	
Signals Out:	Digitized I and Q signals	

Revision Requirements

DAQ 3 Rev. A required for color Doppler.

DAQ 1 Rev. 10 ok for Pulsed Doppler only.

Function

The DAQ is essentially a high speed analog-to-digital converter. The DAQ receives the analog I and Q signals from the BBQ, digitizes both and then passes these signals to the DSP and FEC.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

The DAQ is a key component in Pulsed Doppler, AUX CW Doppler, CW Doppler and color Doppler functions. Any corruption of Doppler signals that is common to all of these modes may be caused by the DAQ or the BBQ. Replace each board in turn to determine which is defective.

DCP — Display Control Processor Board

P/N:	DCP 1	13322T
	DCP 2	19562T
Quantity:	1	
Power Supplies:	+12V, -12V, +5V	
Buses:	System control bus	
	Remote port interface	
Signals In:	Physio Interface	
Signals Out:	Graphics to CVC	
	Doppler spectral position to IC	

Revision Requirements

DCP 2 requires SCM 2 Rev. U or higher.

DCP 2 Rev. A ok for all systems.

DCP Rev. H required for digital VCR playback.

DCP Rev. 7 ok for all other systems.

SCM not required for M-mode if DCP 2 is present.*

*Refer to System Switch Configurations in Section 2 for proper jumper settings.

Function

The DCP board does not directly handle any Doppler data or physio interface data. However, it does play a major role in the display of this data by controlling its transfer to the IC. Also, special graphics data is passed to the CVC. The DCP board:

- Initiates transfer of M-mode data from the SCP.
- Initiates transfer of spectral data from the DSP.
- Controls placement of cardiac M-mode data on the monitor.
- Controls placement of Doppler data on the monitor.
- Generates waveform displays.
- Generates and positions the erase bar on the strip display.
- Generates scales and baseline for the strip display.
- Stores ECG and Physio traces.
- DCP 2 generates M-mode in place of SCM.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

Problems with any of the functions listed above may involve the DCP, CVC (or VC), or IC. Replace each of these boards in turn to isolate problems.

DSP — Doppler Spectral Processor Board

P/N:	DSP 2 14922T
Quantity:	1
Power Supplies:	+12V, -12V, +5V
Buses:	System control bus Doppler digital bus
Signals In:	Digitized I and Q from DAQ
Signals Out:	Frequency domain data to the IC I and Q data for the AUD

Revision Requirements

DSP 2 Rev. 2 ok for all systems.

Function

The Doppler Spectral Processor is used to convert the time domain Doppler data digitized by the DAQ to frequency domain data suitable for display in spectral Doppler modes. This data is then passed to the IC. The DSP also prepares data for use by the Audio Processor (AUD). This data is used to synthesize the Doppler audio signal for the speakers.

Troubleshooting.

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

Suspect the DSP whenever the spectral data or audio data is corrupt. If the problem is unique to the spectral display, i.e. the audio is not corrupted, the problem is likely to be with the DSP or IC.

If the problem is unique to the audio, i.e. the spectral display is not corrupted, the problem is likely to be the DSP or AUD.

If the problem is manifest on both audio and on the spectral display the problem is likely to be the DSP, the DAQ or the BBQ.

Isolate the problem by replacing the appropriate circuit boards.

ECG and Physio — Electrocardiogram and Physiologic Module

P/N:	ECG 2	20251
	ECG and Physio	
	128XP	24212
	128	24606
Quantity:	1	
Power Supplies:	+12V, -12V	
Buses:	N/A	
Signals In:	ECG leads, Auxiliary signal	
Signals Out:	ECG signal, AUX signal, Pulse signal, Phono signal	

Revision Requirements

ECG 2 ok for all systems.

Function

The ECG and Physiologic Module is an accessory that may be installed on an Acuson 128XP. A system may have the ECG module by itself. This is referred to as an "ECG Module". A system may have an ECG module and a Physiologic module. The combination is referred to as an "ECG and Physio Module", which allows the display of an ECG, an auxiliary signal, heartsounds, respiration and pulse signals from specialized transducers.

CAUTION: The ECG and Physio Module is not designed for use in conjunction with electrosurgery or diathermy equipment.

The ECG and Physio Module mounts in the lower cart of the Acuson 128XP, just above the camera bay. It is secured by two screws, one located at the left and the other at the right edge of the front panel. In addition, the rear of the ECG and Physio Module is held in place with a clip or a piece of high-density foam. Three cables are connected to the ECG module: the power cable P1, Physio Interface cable P2, and the phono jack P4. The power and Physio Interface cables also connect to the Physio module.

The ECG and Physio Module is powered by the +12V and the -12V taken from the Scan Converter power supply.

The ECG, auxiliary waveform, pulse, trigger and heartsound signals as well as the status lines, are passed to the DCP and SCM circuit boards in the Scan Converter card cage via the ECG Physio Interface cable. The beeper signal is passed to the AUD circuit board via the phone jack.

CAUTION: To reduce the risk of electric shock or burns, use ONLY the patient cable and leads supplied with the unit. Use of ECG cables other than those supplied by Acuson could defeat the current limiting and electrical safety features of the ECG. For best performance and optimal recovery time, use the Acuson silver-silver chloride electrodes. Additional patient cables and lead kits are available from Acuson.

CAUTION: Use only approved transducers with the physiologic channels. The phono, pulse and respiration inputs on the Physiologic module are isolated to meet ordinary patient connection leakage current limits and are marked with the symbol .

Connect physiologic transducers to the isolated inputs only.

Ground-referred input jacks on the Physiologic module are marked with the symbol .

Do not connect physiologic transducers to a ground-referred jack.

Troubleshooting

WARNING!! Do not remove this assembly with the power on. Cables are connected to the back of the ECG and Physio Module. Use care when removing or installing this assembly.

The ECG and Physio Module may be used in conjunction with Imaging Cine and to trigger the 2-D image updates. Faults with the ECG, SCM or DCP may affect operation of these functions.

ECG faults and their probable causes are listed below. A calibration signal is available and may aid in troubleshooting. To activate this signal press the `RST/CAL` toggle switch to `CAL`.

No ECG trace or CAL trace

Verify that the +12V and -12V are present at ECG P1. If power is present at the ECG module, the Physio Interface cable, the SCM or the DCP is defective.

No ECG trace

If no ECG trace is present but the CAL signal is still displayed, the ECG module may be faulty or the ECG cable or patient leads may be defective.

No CAL trace

If the CAL trace is missing, but the ECG signal is still displayed, the ECG module is faulty.

Image does not update on trigger

If the image does not update on the trigger functions, the DCP, ECG module or Physio Interface cable may be defective.

No beeper on R wave

If the beeper is not audible when activated, the ECG module, phono jack/cable or the AUD may be defective.

No AUX signal

If the AUX signal is not present, the ECG, SCM or Physio Interface cable may be defective.

No HPR signal

If the heartsounds, pulse or respiration signal is not present, the corresponding physiologic transducer may be defective. If none of these signals is present, verify the +12V and -12 V are present at the Physio module. If power is present, the ECG and Physio Module, SCM or Physio Interface cable may be defective.

FEB — Flow Estimator Buffer Board

P/N:	FEB 1	17812T
	FEB 2	19522T
Quantity:	1	
Power Supplies:	+5V	
Buses:	System control	
	Color data bus	
Signals In:	Data from FEC	
Signals Out:	Velocity and variance data	

Revision Requirements

FEB 2 Rev. D ok for linear color systems.

FEB 1 Rev. F or FEB 2 Rev. K required for Spatial Persistence.

FEB 1 Rev. D required for sector color Doppler.

FEB 1 Rev. 7 ok for linear color Doppler.

Function

The FEB is used exclusively in color Doppler systems in conjunction with a FEC and CSC. It receives data from the FEC and extracts velocity and variance data. These parameters are then stored. The FEB is capable of storing the most recently acquired frames of color Doppler and M-mode information for use in conjunction with Imaging and Strip Cine (requires CMB). This data is then read out by the CSC in sync with the video raster. The Spatial Persistence function is performed on the FEB.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

Problems with the FEB will generally appear in one of the following ways:

Noise

Noise in the color Doppler display will appear as colored pixels randomly appearing in the color RES box. It is normal to see a large number of these when the CD level knob is turned fully clockwise (transducer connected but not imaging anatomy). With the CD level knob about halfway, there should be significantly fewer pixels randomly lighting. With the CD level knob fully counterclockwise there should be no colored pixels lighting.

Incorrect color information

Artifacts such as color lines or color blocks appear.

No Color Doppler signal

With the CD level knob fully clockwise, no color signal or noise appears.

The FEB is used for color Doppler processing only. This data path is separate from the spectral Doppler data path. Therefore, problems with the FEB will generally manifest themselves only in the color Doppler display. If any of these symptoms appear, check the spectral Doppler for similar problems. Problems common to both may be caused by the BBQ, DAQ or power supplies. If the problem is only seen in color Doppler, try replacing the FEB, FEC and CSC.

FEC — Flow Estimator Calculator Board

P/N:	FEC 2 19202T
Quantity:	1
Power Supplies:	+5V
Buses:	Doppler digital bus Remote port Interface bus System control bus
Signals In:	Digitized I and Q from DAQ
Signals Out:	Data to FEB

Revision Requirements

FEC 2 Rev. B required for all color Doppler systems.

FEC 1 not supported on XP's.

Function

The FEC is used exclusively in color Doppler systems in conjunction with a FEB and CSC. The Flow Estimator Calculator extracts data from the Doppler data that has been digitized by the DAQ. This data is then passed on to the FEB.

Troubleshooting.

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

Problems with the FEC will generally appear in one of the following ways:

Noise

Noise in the color Doppler display will appear as colored pixels randomly appearing in the color RES box. It is normal to see a large number of these when the CD level knob is turned fully clockwise (transducer connected but not imaging anatomy). With the CD level knob about halfway, there should be significantly fewer pixels randomly lighting. With the CD knob fully counterclockwise there should be no colored pixels lighting.

Incorrect color information

Artifacts such as color lines or color blocks appear.

No Color Doppler signal

With the CD level knob fully clockwise, no color signal or noise appears.

The FEC is used for color Doppler processing only. This data path is separate from the spectral Doppler data path. Therefore, problems with the FEC will generally manifest themselves only in the color Doppler display. If any of these symptoms appear, check the spectral Doppler for similar problems. Problems common to both may be caused by the BBQ, DAQ or power supplies. If the problem is only seen in color Doppler, try replacing the FEC, FEB and CSC.

FPC — Front Panel Controller

P/N:	FPC 4 20412T
Quantity:	1
Power Supplies:	+18V, +5V
Buses:	Front panel interface bus
Signals In:	Panel switches Potentiometers
Signals Out:	Digitized potentiometer data matrix number of pressed switches

Revision Requirements

FPC 4 Rev. C required for all XP systems.

FPC 1, 2, 3 no longer supported.

Function

The Front Panel Controller board scans the operator controls and informs the Scan Converter of any changes in the state of the operator controls.

The Front Panel Controller employs a microcomputer chip that monitors the keyboard and special function buttons. An A/D converter on the FPC converts the outputs of the DGC pots and gain pots to a digital signal which is also read by the microcomputer.

The ID code for the AUX CW transducer is also read by the FPC on systems so equipped.

The user control data is then passed to the Output Controller via the System Interconnect or Common System Interconnect board.

The thermistor circuitry that measures the temperature of thermal sensing probes is found on the FPC.

Troubleshooting

This board is located directly below the keyboard. See Figure 6-1.

Parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

See the Scan Converter Troubleshooting section.

IC — Input Controller Board

P/N:	IC 2 12902T
Quantity:	1
Power Supplies:	+12V, -12V, +5V
Buses:	Scanner Interface bus
	Analog Video bus
	Local Control bus
	MMB Data bus
Signals In:	Analog ultrasound data
	Sync signal from Scanner
Signals Out:	Digitized ultrasound data
	Data addresses for MMB

Revision Requirements

IC 2 Rev. L ok for all systems.

Function

As each ultrasound line is fired, the analog ultrasound video signal from the Scanner is delivered to the Input Controller. An analog-to-digital converter samples the ultrasound video and stores the data into a set of input buffers. Logic on the Input Controller coordinates the handshake between the Scanner and Scan Converter for ultrasound line synchronization. An address calculator generates the addresses to write the data from the input buffers to the MMB.

The Input Controller functions are:

- Real time Scanner handshake and sampling interface
- Analog-to-digital conversion of ultrasound data and high speed data buffering
- Transducer format to rectilinear scan conversion

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

See the Scan Converter Troubleshooting section.

MMB — Main Memory Board

P/N:	10162T
Quantity:	1
Power Supplies:	+5V
Buses:	Local Control Bus
	MMB Data Bus
	Video Image Bus
Signals In:	Digitized ultrasound data.
Signals Out:	Ultrasound data in sync with raster

Revision Requirements

MMB Rev. 5 ok for all systems.

CMB replaces MMB for systems equipped with Cine Option.

Function

The MMB is the RAM buffer for the digitized ultrasound video information. Its primary functions are to provide the buffer storage area necessary to perform time-base correction between the variable frame rate ultrasound scan and the fixed frame rate TV raster scan, and to perform scan conversion from the ultrasound scan format to the video raster format. Secondary functions include persistence generation and gray level mapping (postprocessing).

The MMB functions are:

- Storage of image data
- Time base correction
- Persistence
- Postprocessing

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

See the Scan Converter Troubleshooting section.

OC — Output Controller Board

P/N:	OC 3	22082T
Quantity:	1	
Power Supplies:	+5V	
Buses:	System Control Bus	
	Local Control Bus	
	MMB Data Bus	
	Video Image Bus	
	Video Sync Bus	
Signals In:	Data from MMB	
Signals Out:	Image data in sync with video raster	

Revision Requirements

OC 3 Rev. C ok for all systems.

OC 2 and OC 1 not supported on XP's.

Function

The Output Controller contains a microprocessor that controls all operations of the Scan Converter. Most program memory, as well as the system and local clock circuitry, is located on the Output Controller. The Output Controller reads the ultrasound information from the Main Memory board (MMB) and generates the necessary sync signals for the video output. The Output Controller also contains a filter for special processing of the video data.

The OC functions are:

- System Control
- System Clock Generator
- Video Raster Generator
- Special Processing Filter

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

See the Scan Converter Troubleshooting section.

PEM — Prom Expansion Module

P/N:	16592T
Quantity:	1
Power Supplies:	+5V
Buses:	System Control Bus

Revision Requirements

PEM Rev. 1 ok for all systems.

CVC replaces PEM in common cart systems.

Refer to System Switch Configurations in Section 2 for proper jumper settings.

Function

The PEM is a half-height PCB which provides extra PROM sockets for operating system software.

Troubleshooting

The PEM board contains very few components and is unlikely to fail. However, if symptoms resembling OC - type problems develop (in systems , and troubleshooting the OC 3 is unsuccessful, then swap the PEM board and retest the system.

WARNING!! Do not remove or install a PCB with the power on.

See the Scan Converter Troubleshooting section.

SCM — Strip Chart / M-mode Board

P/N:	SCM 2 14282T
Quantity:	1
Power Supplies:	+12V, -12V, +5V
Buses:	System control bus
	Remote port interface
	A / D bus
	Physio interface bus
Signals In:	M-mode data
	Doppler / M-mode strip data
Signals Out:	SCR control signals
	SCR data signals
	cardiac M-mode cycle control

Revision Requirements

SCM 2 Rev. B required for all CW Doppler.

SCM 2 Rev. T or lower incompatible with DCP 2.

SCM required for SCR signals, but not required for M-mode if DCP 2 present.

Function

The SCM board's primary function is control of the strip chart recorder (SCR) interface. The signals generated for this purpose are:

- Comp Blank
- Print
- Z
- Unblank
- X
- Run
- Speed
- Video

These are passed to the SCR via the CSI.

The SCM also is used to control the cardiac M-mode cycle, unless a DCP 2 is present.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

Problems with SCR operation or cardiac M-mode operation may be caused by a defective SCM. To isolate the problem replace the SCM board.

SCMB — Scan Converter Motherboard

P/N:	Common cart	16952T
	Non-common cart	12042T
Quantity:	1	
Power Supplies:	+12V, -12V, +5V	
Buses:	System Control Bus	
	Local Control Bus	
	MMB Data Bus	
	Video Image Bus	
	Graphics Data Bus	
	Video Sync Bus	
Signals	All Scan Converter signals.	

Revision Requirements

None.

Function

The Scan Converter Motherboard is a multi-layer, impedance-matched PC board. It provides the interconnection between each of the Scan Converter circuit boards. The pins are press-fit into the board. No solder connections are used. This adds to the reliability of the Scan Converter. The PC board contains 10 conductive layers of etching. See Figure 4-8.

Troubleshooting

The SCMB provides an interconnect path for virtually everything in the Scan Converter card cage. Due to the variety of SCMB failures that are possible, and the number of test points that would need to be verified, the only practical means of troubleshooting the SCMB board is to replace it. Replace the SCMB only if all other possible causes for a given failure are ruled out. There are no active components on the board so failures are unlikely. Most failures are caused by debris in the edge connectors and bent pins.

SI — System Interconnect Board

P/N:	SI 1	10542T
	SI 2	13922T
Quantity:	1	
Power Supplies:	+5V, +12V, -12V	
Buses:	System Control Bus	
Signals In:	*	
Signals Out:	*	

* All signals to or from the Scan Converter (except the Physio Interface) are passed through the SI.

Revision Requirements

SI 2 Rev. 3 required for Pulsed Doppler.

SI 2 Rev. 2 ok for B/W, non-Doppler systems.

SI 1 Rev. C required for Pulsed Doppler.

SI 1 Rev. 2 ok for B/W, non-Doppler systems.

Function

The System Interconnect provides the interface between the Scan Converter, Scanner, Front Panel Controller, and system recording devices. The System Interconnect provides serial/parallel and parallel/serial conversion through a USART. The System Interconnect also provides signal buffering and address decoding logic for use of the System Bus and dual port lines.

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

WARNING!! Do not remove or install a PCB with the power on.

The System Interconnect board is located along the rear panel of the Scan Converter card cage. To remove the System Interconnect board from the Scan Converter, remove the Scan Converter rear panel and disconnect all the coax and ribbon cables.

Because the signals between the Scanner and the Scan Converter flow through the SI, power-up errors such as "S.INTRPT power-up error" (which indicates a problem with interrupts from the Scanner) may be caused by a defective SI board. See the Scan Converter Troubleshooting section.

VC — Video Controller

P/N:	VC 1	10372T
	VC 2	17632T
Quantity:	1	
Power Supplies:	+5V, +12V, -12V	
Buses:	System control bus	
	Graphics data bus	
	Video image bus	
	Video sync bus	
Signals In:	2-D image data from OC	
	Graphics data from OC and DCP	
Signals Out:	Composite video signal	

Revision Requirements

VC 2 required for Digital VCR Playback.

VC 2 Rev. C ok for all but color Doppler systems.

VC 1 Rev. A ok for all but color Doppler systems.

VC replaced by CVC in common upper cart systems to support color Doppler.

Function

The main function of the Video Controller is to receive digital signals from several busses, combine them, and convert the signals to analog RS-170 (or PAL) video for display on a conventional CRT.

Image data from the MMB is transferred to the Video Controller via the System Image Bus on the Scan Converter Motherboard. The Video Controller generates the required graphics and alphanumeric data to overlay on the ultrasound image through a combinational logic system. Joined with sync signals, the digital video signal is converted to a standard RS-170 analog composite video signal by a D/A converter.

Two unrelated features of the Video Controller are the time-of-day clock, and the battery-backed-up RAM. The clock and RAM are backed by battery power when the system is not powered on. The RAM will maintain information and the clock will maintain accurate time after the power is removed.

The functions of the Video Controller are:

- Generation of graphics
- Generation of alphanumerics
- Overlay of graphics/alphanumerics/image data
- Video digital-to-analog conversion
- Time of day clock
- Battery-backed up RAM

Troubleshooting

Substantial parts of this board are tested when the system is turned on or reset. If an error occurs replace the board.

Note: The battery-backed-up RAM stores all user programs as well as other parameters unique to your system. If replacement of this board is required, contact Acuson Technical Support for information regarding the configuration of your system.

WARNING!! Do not remove or install a PCB with the power on.

See the Scan Converter Troubleshooting section.

SECTION 5

Power Supply

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The power supplies described in this section are for Acuson 128XP/10, 128XP/5, and 128XP/E systems. Refer to service manual part number 19018 or 23151 for a description of the power supplies in earlier systems.

There are two versions of the power supply used in the Acuson 128XP: domestic and international. The nomenclature "domestic" is used to refer to systems which require 100/115VAC at 60Hz. "International" refers to systems which use 220/240VAC at 50 or 60Hz. These are two different supplies and cannot be modified in the field to replace one another.

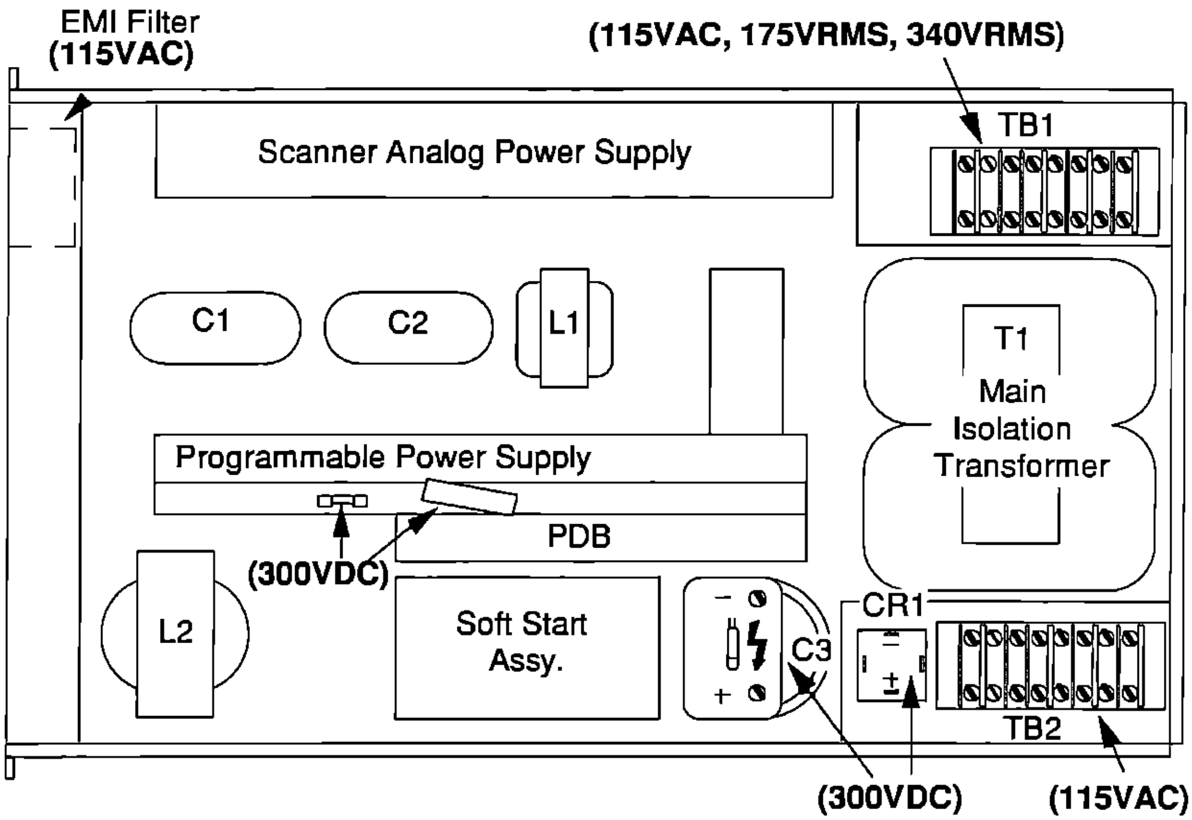
The power supply is composed of three main sections: the Power Supply Tray, the Scanner Digital Power Supply and the Scan Converter Power Supply. Switching power supplies are used exclusively because of their high efficiency. The power supply offers temperature sensing fans, fault reporting, and reduced leakage current.

DANGER!! In addition to power line voltage, 150VDC and 300VDC are also present in the power supply tray. Because of these high voltages, the entire tray should be treated with caution. However there are some areas which can be particularly hazardous. These are: C3 (large electrolytic capacitor with neon lamp which lights when 300V is present), the fuse and resistor on top of the Programmable Power Supply (PPS), CR1 (diode bridge near TB2), both terminal blocks (TB1 and TB2), the EMI filter and all Orange and White/Black wiring. Also present is 300VDC in the Scanner Digital Power Supply and the Scan Converter Power Supply, within the area bordered by dotted lines labeled: "High Voltage" (see Figures 5-1, 5-5, 5-6 and 5-7).

CAUTION: To ensure the safety of the patient and sonographer measure the amount of leakage current from the AC power line connections to chassis ground after any service activity which involves any wiring on the primary side of the main isolation transformer. Primary-side circuitry includes the EMI filter, circuit breaker, soft-start assembly and PDB 2. Contact your Acuson customer engineer if you need assistance in making this measurement.

Power Supply Tray

The power supply tray is located beneath the system. It rolls out to the rear once the four retaining bolts and filter bracket are removed. The primary AC wiring, main isolation transformer, soft-start circuitry and Power Distribution Board 2 (PDB 2) as well as the Scanner Analog Power Supply and Programmable Power Supply (PPS), are located in the tray.



Note exposed high voltages

Figure 5-1. Power Supply Tray

Scanner Digital Power Supply

The Scanner Digital Power Supply is located behind the left dress panel (as you face the keyboard) towards the rear of the system. It can be accessed by removing the dress panel and protective cover.

Scan Converter Power Supply

The Scan Converter Power Supply is located in the upper cart beneath the Scan Converter. It is accessed by opening the upper cart and removing the protective cover.

Power Supply Architecture

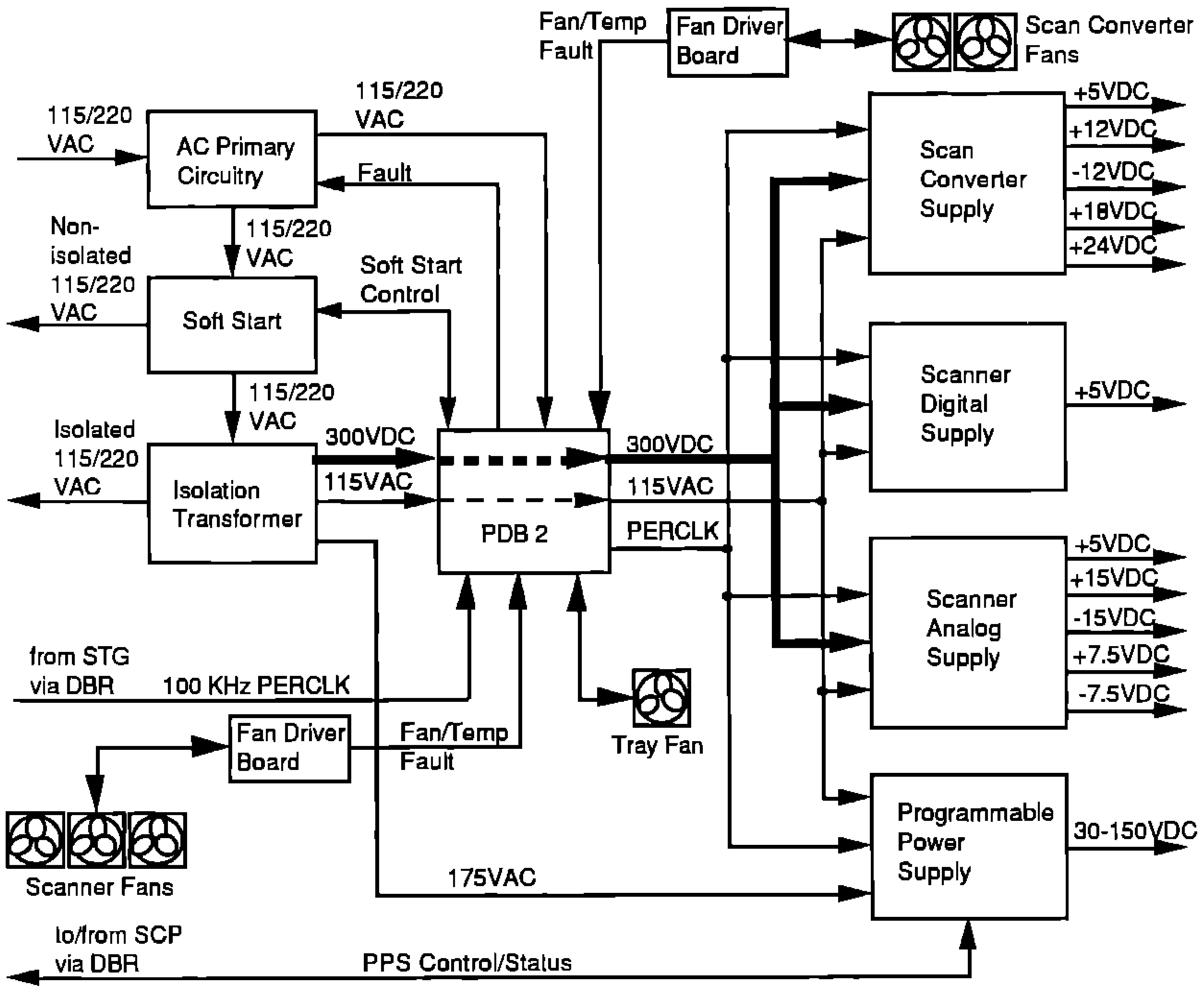


Figure 5-2. Power Supply Block Diagram

The power supply used in the Acuson 128XP comprises four individual switching power supplies. Three derive their voltages from a 300V high voltage bus, originating from one secondary winding of the isolation transformer. The fourth supply, the Programmable Power Supply (PPS), derives its voltage from a separate 175VAC secondary of the same transformer. See Figures 9-12 and 9-16.

All four supplies receive isolated 115VAC and a clock signal named PERCLK. The 115VAC is used to provide housekeeping voltage for each supply while the PERCLK signal, which is generated by the Scanner Timing Generator (STG), is used to synchronize the individual supplies.

The power supply was designed to provide reliable power under a wide range of conditions. The Power Distribution Board 2 (PDB 2) is responsible for this. If problems should arise, either with external power or individual supplies within the system, the PDB 2 will shut the system down and illuminate an error light. If the system should power down of its own accord, open the power supply tray and make note of the 7-segment display located on the top of the power supply tray, behind the main air filter. This will be helpful in determining what caused the system to power down.

DANGER!! High voltages are present on and in the vicinity of the PDB 2.

Theory of Operation (See Figures 9-12 and 9-16)

AC Power Conditioning

Primary AC enters the system via a hospital-grade power cord. It is then passed through the EMI Filter, which attenuates conducted noise in the RF spectrum and decouples earth ground from system ground to reduce the effects of earth ground noise. A 47K ohm resistor (68K on international systems) is placed across the primary AC outputs of the EMI Filter. This is needed to bleed off the charge stored in the filter capacitors when the system is unplugged from the AC outlet. The hot leads (black) are routed to a 15A circuit breaker, CB1 (both leads go to a 12.5A breaker on international systems).

In addition to sensing over-current, this circuit breaker may also be tripped by the Power Distribution Board 2 (PDB 2) in the event of an over-voltage condition, or an over-current condition on the 300V bus discharge resistor.

Primary AC Wiring

After the circuit breaker, primary AC is routed to the power relay (SW1), from there to the terminal block TB2, then on to the primary side of the main power switch. From the main power switch it goes back to TB2 then continues on to the PDB 2. The other side of the power relay is connected to the soft-start circuit.

Soft-start

To reduce in-rush current when the system is switched on, a 3Ω, 50W resistor and a 5A SloBlo fuse are placed in series with the transformer (the international version has two 3Ω, 50W resistors and a 4A SloBlo fuse).

IMPORTANT: Be sure to replace fuses with the same rating and type.

The 3Ω resistor is switched out of the circuit by SW2 shortly after turning on the system to prevent it from overheating. If the temperature of the resistor ever exceeds 69°C, a thermal switch closes, causing the PDB to open the power relay and display an error code 6. Rapid cycling of the main power switch can cause the resistor to overheat and shut the system down.

The PDB 2 requires approximately 1 second to power down and reset. Allow this time or the system will stay off until the power switch is cycled again.

Secondary AC Wiring

There are three secondary windings on the main power transformer. The first, 175VRMS, is full-wave rectified to provide 230VDC to the PPS. The second, isolated 115VAC, is routed to the PDB 2 through J100 pins 7 and 10. This provides switched power to the control circuitry on the Scanner Analog and Digital Supplies and Scan Converter Supply. This winding is also connected to the Power Factor Corrector and the Isolated Power Outlets. The third, 340VRMS, is used to produce the 300VDC Bus.

Voltage Strapping

The main power transformer may be strapped for two primary AC voltages: 100VAC and 115VAC (220VAC and 240VAC on international systems). These options are provided for special power requirements for different countries and are not intended to be used to compensate for high or low line voltage conditions.

Note: There is a corresponding strapping option in the secondary for each primary. This must be changed to correspond to the voltage that is selected on the primary side so the Isolated Outlets will be the correct voltage. Example: If the primary is strapped for 100VAC, the secondary should also be strapped for 100VAC.

300 Volt DC Bus

The 300VDC bus is derived from the 340VRMS winding by a bridge rectifier and an LC Filter (L2 & C3). It is then routed to the PDB 2 and distributed to the other power supplies in the system. System operating voltages are derived from the 300VDC bus (except for the housekeeping voltages on each supply which are derived from isolated 115VAC and the 150VDC on the PPS which is derived from 175VRMS). A 150Ω resistor is switched into the 300V bus to function as a load during power up and to bleed off accumulated charge when power is switched off. A 500mA fuse protects this resistor in the event the PDB 2 fails to switch it out of the circuit after power up.

Power Factor Correction

There are two 50µF, 450VAC capacitors and an 8mH inductor in the 115V secondary of the main power transformer. These condition the current waveform, which if left uncorrected, would cause the AC power source to see higher than actual power consumption.

Power Fail Signal

The PDB 2 provides a signal to interrupt the Scan Converter to save data to the battery-backed RAM in the event of power loss. Malfunction of this signal may cause a CVC power-up error or cause the main program in the OC to stop running.

PERCLK

PERCLK is a 100KHz clock generated on the STG. It is a differentially driven signal from the DBR to the PDB 2 used to synchronize the switching frequency of the various switching power supplies within the system. If PERCLK is not present the PPS will not operate.

Power-on Sequence

The power-on sequence is needed to provide a safe and repeatable system power up. This section explains how the individual components interact to power the system.

With the power cord plugged into an active wall outlet and the main breaker (CB1) up, the power switch is flipped up. This applies 115 VAC (220VAC for international systems) to the PDB 2. The PDB 2 powers up and senses that the 115VAC is greater than approximately 95VAC or (182VAC for international systems). If the Soft-Start resistor is over-temperature, the system will remain in this state.

If it is not, the PDB will:

- Energize the main power relay on the soft-start assembly.

This applies 115VAC (220VAC for international systems) to the power transformer. The transformer's 340V RMS output will begin to charge the 300VDC bus. When the 300 volt bus reaches 250V, the PDB will:

- Switch in the 150Ω 300 volt bus load resistor (to prevent 300V bus overshoot).
- Energize the soft-start relay bypassing the 3Ω resistor (6Ω for international).
- Initiate a 450ms pulse (the 18V supply is checked for correct voltage at the trailing edge of the pulse).
- Provide 115 VAC to the power supplies by closing K1.

If the the 300 volt bus does not reach 250V within 450ms, then the system will turn off and the 7-segment display will show "2." (the period denotes that it was a power-up error).

The 115VAC brings up the control circuitry in each of the Scanner Analog, Scanner Digital and Scan Converter supplies. Each supply has its own independent soft-start circuitry which limits in-rush current once the control circuitry has been powered.

As the Scanner Digital supply comes up it activates the PERCLK circuitry on the STG. On the trailing edge of the 450 ms pulse the PDB 2 verifies that 18V from the Scan Converter is present. If it is and no fault indicators are on, the PDB 2 will:

- Drive the PF signal high.
- Turn on the yellow "CLK" LED.
- Enable the Programmable Power Supply.
- Synchronize the power supplies.
- Switch out 150Ω 300V bus load resistor.

During the software power-up sequence the system will interrogate the PPS to verify that it is capable of varying output voltage. If the supply is working correctly then the system will complete its power-on sequence.

Power-off Sequence

The power-off sequence is needed to power down the system in a safe and repeatable manner. It also allows the system time to store important information in battery-backed RAM.

The system will power off if any one or more of the following occurs:

- The main power switch is turned off
- The PDB 2 detects a fault
- The main circuit breaker, CB1, opens
- AC input power is lost

Under all conditions the PDB 2 will:

- Pull the power fail (PF) signal low
- Maintain local +5 Volts for at least one second
- Open K1; disconnect 115 VAC from supplies
- Remove PERCLK
- Release the main power relay
- Switch in the 150Ω load resistor to discharge 300V bus

The PF signal triggers the system to stop what it is doing and save important data in battery-backed RAM.

This completes the power-off sequence.

Power Supply Noise

Power supply noise is generated by the switching of high voltage and current within the power supply. This noise occurs at the primary switching frequency and its harmonics. There are several grounding techniques which have been incorporated throughout the system to minimize noise. Two of the most important are:

- The Scanner top cover MUST be secure with ALL screws. Contact along the center divider is particularly important, but do not overtighten as this can damage the fasteners.
- Conductive rope (P/N 24390 and 24391) is applied between the Scanner Chassis and the front of the cart. An especially critical area is the left front corner of the chassis, near the hinge.

Also, it is important that all the supplies be synchronized. Synchronization is controlled by the 100KHz clock, PERCLK, which originates on the STG.

Power Supply Subassemblies

PDB 2 — Power Distribution Board 2

(Domestic P/N 18452T — International P/N 18452TI)

The PDB 2 is the controller of the power supply. It provides safe operation of the power supply system. The PDB 2 employs opto-isolators which reduce leakage current. In addition, the PDB 2 has a 7-segment display for fault reporting. It also has fan driving circuitry similar to the Fan Driver Boards (FDB), which is responsible for the fans in the power supply tray. The supervisory circuitry on the PDB 2 will power down the system if it is not operating as intended. The table below lists the faults and operating conditions that can cause the PDB 2 to shut down the system.

Revision Requirements

PDB 2 Rev. XB ok for all systems.

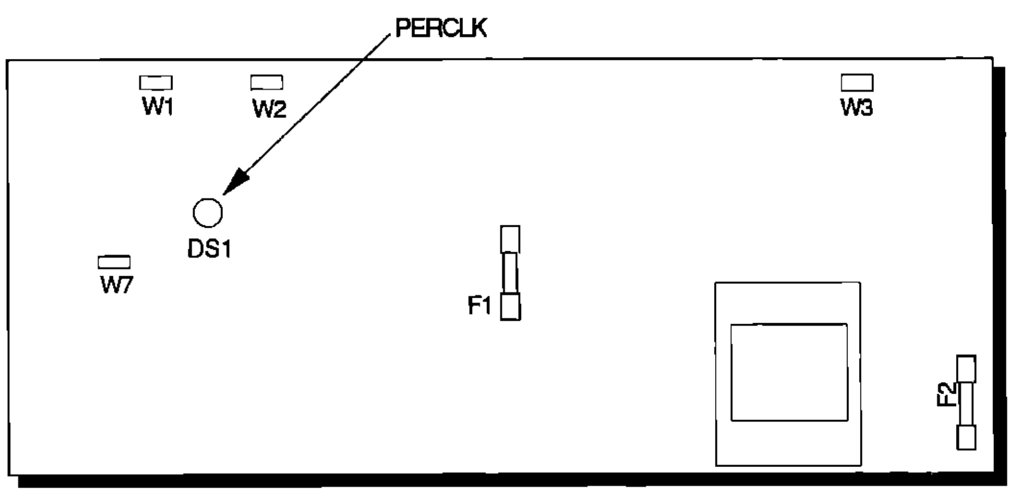


Figure 5-3. Power Distribution Board 2

Indicators

Listed below are the error codes which the 7-segment display can report and the symptoms which can cause the error.

Error	Symptom
1	Low AC line voltage (<95VAC)
2	Low 300V Bus (<250VDC)
3	High 300V Bus (>360VDC)
4	Scan Converter power supply - fault
5	Power Supply Tray - over-temperature or fan fault
6	Scanner - over-temperature or fan fault
7	Scan Converter - over-temperature or fan fault
8	Scanner Digital 5V power supply - fault
9	Scanner Low Voltage power supply - fault
.	Accompanies a 1 or 2 error and denotes that the error was encountered during power-up

The PDB 2 contains a secondary over-voltage protection (OVP) circuit which is powered by the 300 volt bus. This circuit is completely independent of the controller circuitry. It provides a last resort over-voltage protection by opening the main circuit breaker (CB1) at 374V.

Fuses

Fuses	Rating
F1	2A
F2	0.2A (domestic)
	0.063A (international)

Interconnections

PDB interconnections	Functions
Soft-start	Electronically switches main power and soft-start resistor relays; senses resistor temperature.
Isolated 115 VAC	Electronically switched; provides control power to supplies.
300 volt bus	Monitors and controls; distributes to supplies.
Fan Power	Monitors fan voltage (18V) from Scan Converter supply.
PERCLK	Electronically switched; synchronizes power supplies; enables PPS.
Power Fail (PF)	Electronically switched; provides power down interrupt to Scan Converter.
OVP	Trips main circuit breaker; powered by 300 volt bus.
Remote On	Used to power the PDB 2 and close the Power Relay during hipot testing.

Jumpers

Jumper	Comments
W1	Bypasses the fan-power error power-off interlock.
W2	Bypasses all error power-off interlocks.
W3	Tests OVP trip of main circuit breaker.
W7	Removed for use with speed sensing fans.

WARNING: After replacing the PDB 2 be sure to measure the leakage current from the AC line to the system chassis.

Note: When replacing a PDB 2 or Main circuit breaker, test the secondary OVP circuitry by turning off power and installing a jumper on W3. Verify that the circuit breaker trips upon power-up. If the breaker does not trip, troubleshoot and repair as needed. Remove jumper after testing.

FDB — Fan Driver Board

(P/N 18780T)

There are two FDB's. One is located on the right side of the Scanner chassis (as you face the keyboard) inside the air baffle, and a second is located directly under the Scan Converter.

These boards sense fan speed and temperature and will shut the system off if the temperature exceeds 68°C or if the fans stop rotating. To bypass this feature (for troubleshooting purposes) install a jumper at W1 on the FDB or W7 on the PDB 2.

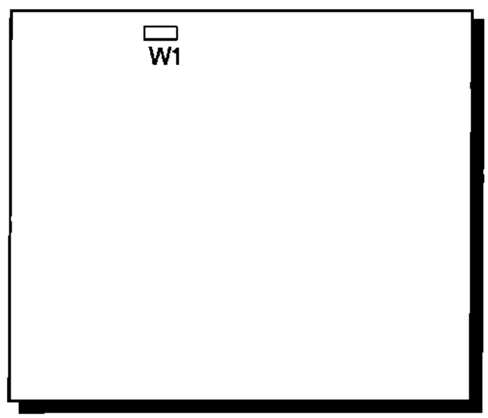


Figure 5-4. Fan Driver Board

PPS — Programmable Power Supply

(P/N 16817T)

The PPS is located in the power supply drawer. It is a high voltage switching DC power supply with variable output. The switching frequency is 25KHz, synchronized with PERCLK. The output, which supplies voltage to the XMT boards through the DBL, is programmable from 30V to 150V via a bus provided by the SCP via the DBR. During 2-D imaging the PPS is set for 150V. The PPS's output may be reduced for Doppler.

CAUTION: When handling the PPS, avoid damaging the capacitors in the vicinity of Test Points 3, 4 and 5 near the top of the PPS.

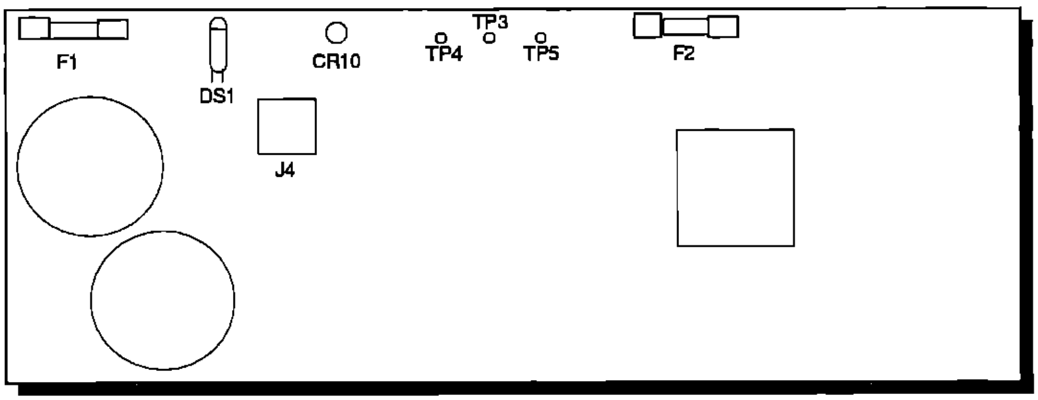


Figure 5-5. Programmable Power Supply

PPS LED's	MEANING
CR10	PERCLK active
DS1	Input filter capacitors are charged to >70V

PPS JUMPERS
W1 - should be installed - grounds unused PAL input

Fuses	Rating
F1	4A
F2	250mA

WARNING! It takes a minimum of 3 minutes for the PPS input filter capacitors to discharge below 50V after the system is turned off.

Scanner Analog Power Supply

(P/N 18923T)

The Scanner Analog Supply, also called the Scanner Low Voltage Supply, is a switching power supply located in the Power Supply Tray. Its switching frequency is 25KHz, synchronized with PERCLK. Its outputs are +5V, +7.5V, -7.5V, +15V and -15V. These supplies are used exclusively by the Scanner analog electronics.

Note: -7.5V is used by the DBL to create a -5V reference for the Receiver PCB's.

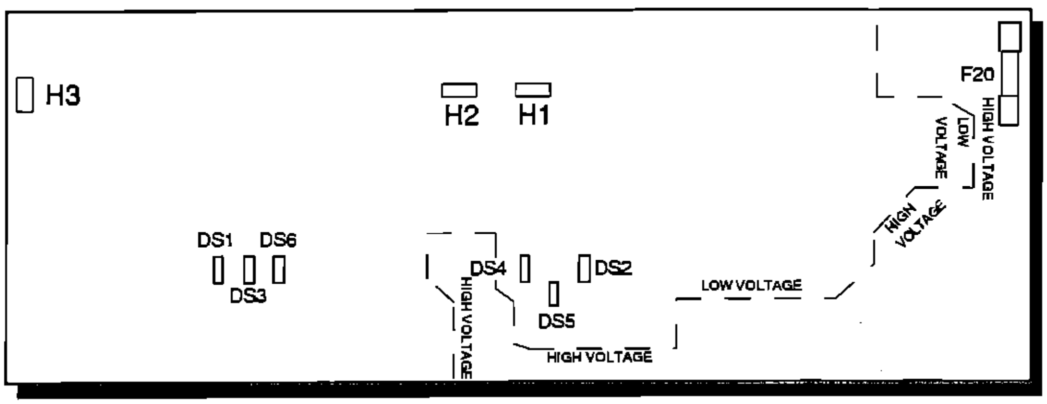


Figure 5-6. Scanner Analog Power Supply

LED's	Meaning
DS1	+15V current limit
DS2	+7.5V current limit
DS3	-15V current limit
DS4	-7.5V current limit
DS5	primary circuit current limit
DS6	+5V current limit

Note: If any of the LED's above are lit, the Scanner Analog Supply will shut down. OVP will cause DS5 to light.

Jumpers	Status
H1	should be jumpered - installs bypass cap between supply return and chassis ground
H2	should be jumpered - installs bypass cap between supply return and chassis ground
H3	should be jumpered - installs bypass cap between supply return and chassis ground

Fuses	Rating
F20	2A

Scanner Digital Power Supply

(P/N 18924T)

The Scanner Digital Supply is a switching power supply located behind the dress panel on the left side (when facing the keyboard) of the system. Its switching frequency is 25KHz, synchronized with PERCLK. It supplies digital +5V to the Scanner.

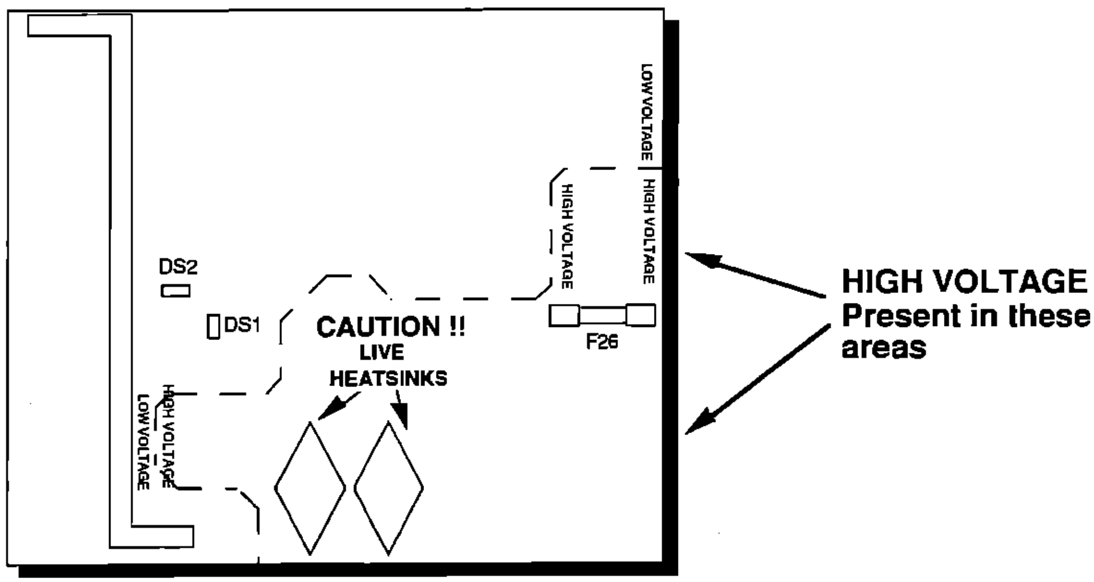


Figure 5-7. Scanner Digital Power Supply

LED's	MEANING
DS1	primary circuit current limit
DS2	over-voltage/over-temperature

Note: If either of the above LED's are lit, the Scanner Digital Supply will shut down.

Fuses	Rating
F26	2A

Scan Converter Power Supply

(P/N 17844T)

The Scan Converter Power Supply is a switching power supply located beneath the Scan Converter. Its switching frequency is 25KHz, synchronized with PERCLK. Its outputs are +12V, -12V, +18V, +24V and digital +5V.

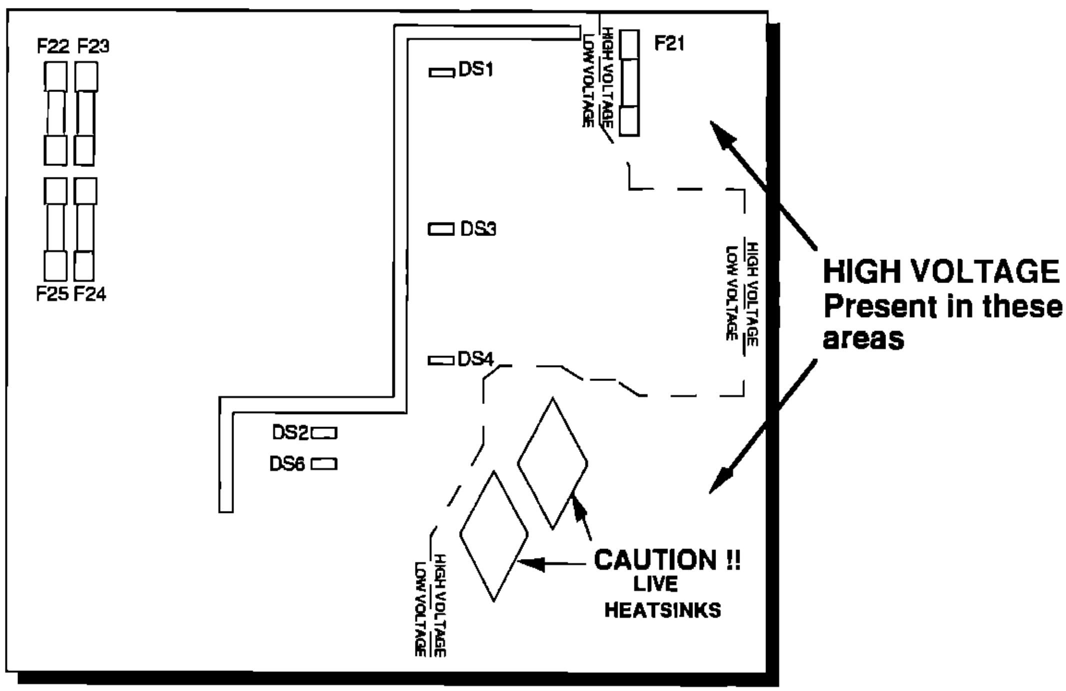


Figure 5-8. Scan Converter Power Supply

LED's	MEANING
DS1	+24V current limit
DS2	+12V current limit
DS3	+18V current limit
DS4	-12V current limit
DS5	primary circuit and +5V current limit
DS6	over-voltage fault

Note: If any of the above LED's are lit, the system will shut down.

Fuses	Rating
F21	5A
F22	2A
F23	2A
F24	2A
F25	2A

Troubleshooting the Power Supply

CAUTION: Jumpers W1 and W2 on the PDB 2 allow you to bypass interlocks which protect the system from damage. If one of the jumpers is installed, operate the system only long enough to isolate the problem. Never leave the system unattended. Remove the jumper after the fault is isolated.

Common Failure Modes and Causes

Symptom: no power - Error #1

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

• low or interrupted AC:	<95VAC	domestic
	<185VAC	international

- faulty PDB 2
- faulty cable or connector
- international PDB 2 installed in domestic system

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - Error #2

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

- low AC line
- low 300V bus (less than 250VDC)
- faulty cable or connector
- faulty PDB 2

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - Error #3

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

- high AC line
- high 300V bus (more than 360VDC)
- faulty cable or connector
- faulty PDB 2
- blown 500mA fuse on the discharge resistor.

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - Error #4

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

- short or excessive load on any output of the Scan Converter supply
  - check error lights for each output of the Scan Converter supply
  - for all but +5V, unplug output to isolate fault

CAUTION: Do not leave sense leads connected when load is not connected.

  - for +5V, remove half of Scan Converter PCB's at one time to isolate fault
- faulty cable or connector
- faulty Scan Converter power supply
- faulty PDB 2

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - Error #5

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

- Soft start resistor over-temperature
- tray fan turning too slowly or stopped
- tray temperature over 65°C
- faulty PDB 2

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - Error #6

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

- Scanner fan turning too slow or stopped
- Scanner temperature over 65°C
- faulty PDB 2

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - Error #7

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

- Scan Converter fan turning too slowly or stopped
- Scan Converter temperature over 65°C
- faulty PDB 2

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - Error #8

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

- Short or excessive load on output of the Scanner Digital power supply
  - check error lights on Scanner Digital power supply
- faulty cable or connector

- faulty Scanner Digital power supply
- faulty PDB 2

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - Error #9

With this fault the system is automatically shut down.

Switch off the main breaker. Place a jumper across W2 to bypass this interlock feature, then power back up to troubleshoot.

Possible causes:

- Short or excessive load on any output of the Scanner Analog (low voltage) power supply
  - check error lights on Scanner Analog power supply
  - for all but 5V, unplug output to isolate fault

CAUTION: Do not leave sense leads connected when load is disconnected.

- faulty cable or connector
- faulty Scanner Analog power supply
- faulty PDB 2

NOTE: Remove the jumper after the cause of failure is determined.

Symptom: no power - main circuit breaker is tripped

Possible causes:

- short circuit in the AC primary circuit
- short circuit in the AC secondary circuit
- power factor corrector not working
- faulty PDB 2
- faulty breaker
- 300V Bus greater than 374V and PDB 2 over-voltage shut-down circuit failed

Symptom: degraded image

Verify voltages from the Scanner Power Supply at test points on the DBL. Check both DC level and AC noise and ripple.

When measuring power supply noise it is critical that the ground lead for the scope probe be as short as possible (one inch or less). A longer ground lead will cause large spikes at the switching frequency to appear on the signal.

Please note that the following specifications are for reference only. Minor deviations are normal and do not affect operation. Failures involving power supply noise are usually quite obvious, producing noise voltages substantially larger than typical values. Failures are most often oscillations at a frequency different from the switching frequency.

	test point	DC min	DC max	typical AC ripple peak-to-peak
+5 analog:	TP8	+4.90	+5.10	25mV
+7.5 analog:	TP7	+7.2	+7.8	60mV
-7.5 analog:	TP6	-7.8	-7.2	25mV
+15 analog:	TP9	+14.5	+15.5	25mV
-15 analog:	TP10	-15.5	-14.5	60mV
150VDC:	TP5	+145	+155	2V

Symptom: no video

Possible causes:

- Scan Converter power supply
  - faulty cable or connector
    (+12V or -12V)
    (+24V (powers monitor on B/W systems))
    (115VAC (powers monitor on color systems))

Symptom: CVC power-up error or system occasionally stops operating (breaks into the monitor)

Possible causes:

- power fail (PF) from the PDB 2 is intermittently or constantly low
- bad cable or connector

Symptom: unreliable FPC operation

Possible causes:

- Scan Converter power supply
  - faulty cable or connector
  - corroded 5V fuse holders or fuses

Symptom: Blown fuse in Soft Start

Possible causes:

- shorted transformer or MOV
- short or excessive load in the secondary of the Isolation Transformer

Hint: Disconnect everything from the secondary of the Isolation Transformer at TB1. If the fuse still blows, the problem is in the primary circuitry or the transformer itself. If the fuse does not blow, reconnect the outputs, one at a time, until it does. If the 300VDC bus is found to be the source, disconnect all of the power supplies connected to the PDB 2 to further isolate.

Specifications

AC Power Consumption

The total AC power consumption for the system will vary greatly depending on the options installed and the operating conditions. Listed below are approximate maximum current values measured at 115VAC.

Type of Equipment	Typical Current Draw @ 115VAC
B&W Radiology System	7 amps
Color Cardiology System w/VCR	11 amps
Strip Chart Recorder	6 amps (Honeywell)
	2.2 amps (Kowa)
Matrix Camera	1 amp
Sony UP-5050W	2 amps

Heat output of the Acuson 128XP is approximately 5000 BTU/hr.

Frequency Tolerance

Domestic	57 - 63 Hz
International	47 - 63 Hz

Line Voltage

	nominal	low	high
Domestic	100VAC	90	110
	115VAC	103	127
International	220VAC	198	242
	240VAC	216	264

Temperature Tolerance

operating	15 to 33°C
storage	-20°C

Power Supply Voltage Usage By Board

Scan Converter Power Supply

PCB	+5V	+12V	-12V	+18V	+24V
CSC	•				
CSI	•	•	•		
CVC	•	•	•		
DAQ	•	•	•		
DCP	•	•	•		
DSP	•	•	•		
FEB	•				
FEC	•				
IC	•	•	•		
MMB	•				
OC	•				
SCM	•	•	•		
SIB	•	•	•		
VC	•	•	•		
CED	•	•	•		
FPC	•			•	
ECG	•	•	•		
AP		•	•		
PDB 2				•	
FDB				•	
S.C. fans					•
B/W mon					•

Scanner Analog, Scanner Digital, and Programmable Power Supply

	Scanner Analog					Scanner Digital	PPS	-5V (from
	+15V	-15V	+7.5V	-7.5V	+5V	+5V	150V	-7.5V on DBL)
APD	•	•	•			•		
AUX	•	•			•			
BBQ	•	•			•			
DBL	•	•	•	•	•		•	
DBR	•				•	•		
DCC						•		
IGD	•	•			•			
MEX						•		
MXK				•		•		
RCV	•	•			•			•
SCP						•		
SDL			•	•	•	*		
STG	•	•				•		
TDI	•			•				
TRM						•		
VDT	•	•			•			
XDY						•		
XMT	•	•			•		•	

*(not used by SDL but has motherboard connection)

Power Supply Fuses and Test Points

Power Supply	Voltage	Test Point	Fuses	Fuse P/N	Type	Sense
Scan Converter	+5V digital		F24 F25	12378 12378	2A 2A	yes
	+12V					yes
	-12V					yes
	+18V		F22	12378	2A	
	+24V		F23	12378	2A	
	300VDC		F21	11259	5A	
Scanner Analog	+15V	TP10	F20	12378	2A	yes
	-15V	TP9				yes
	+7.5V	TP7				yes
	-7.5V	TP6				yes
	+5V analog	TP8				yes
Scanner Digital	+5V		F26	12378	2A	yes
PPS	150VDC	TP5	F1 F2	13199 16693	4A 250mA	
PDB 2			F1 F2	12378 16693 10090	2A 0.2A (domestic) 0.063A (internation	

SECTION 6

Preventative Maintenance

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Preventative Maintenance Checklist.

The following checklist covers the PM procedure for Acuson 128XP/10, 128XP/5, and 128XP/E systems. As mentioned earlier in this manual, these systems have a slightly different weldment than earlier systems which have been converted to XP capabilities in the field. Therefore, the filter locations, fan operation, power cord and power supplies differ. Please refer to service manual part number 19018 or 23151 for information in order to complete the checklist which follows.

You may want to duplicate this checklist to use on a regular basis.

Preliminaries

- ☐ Contact the primary user of the system. Discuss any discrepancies in system operation.

- ☐ Document and resolve any system performance problems. Refer to section 2, 3 and 4 of this manual for troubleshooting assistance.

Mechanical / Visual inspection

- ☐ Verify the operation of all switches, knobs, and user controls. They should be clean and operate smoothly. See System Care in Section 1 of this manual for cleaning instructions.

- ☐ Check the internal and external cable routing for each cable assembly. Cables should not be stretched or kinked. Connectors should be firmly seated.

- ☐ Check the connectors on the power cables for any deformation or discoloration due to resistive heating of connector pins. Replace cables if necessary.

☐ Check transducer holders for damage. Replace if required.

☐ Clean or replace the air filters.

There are two filters, both externally accessible by loosening and removing captive thumb screws (Figure 6-1):

- Upper air filter (right side of system)
- Lower air filter (rear of system)

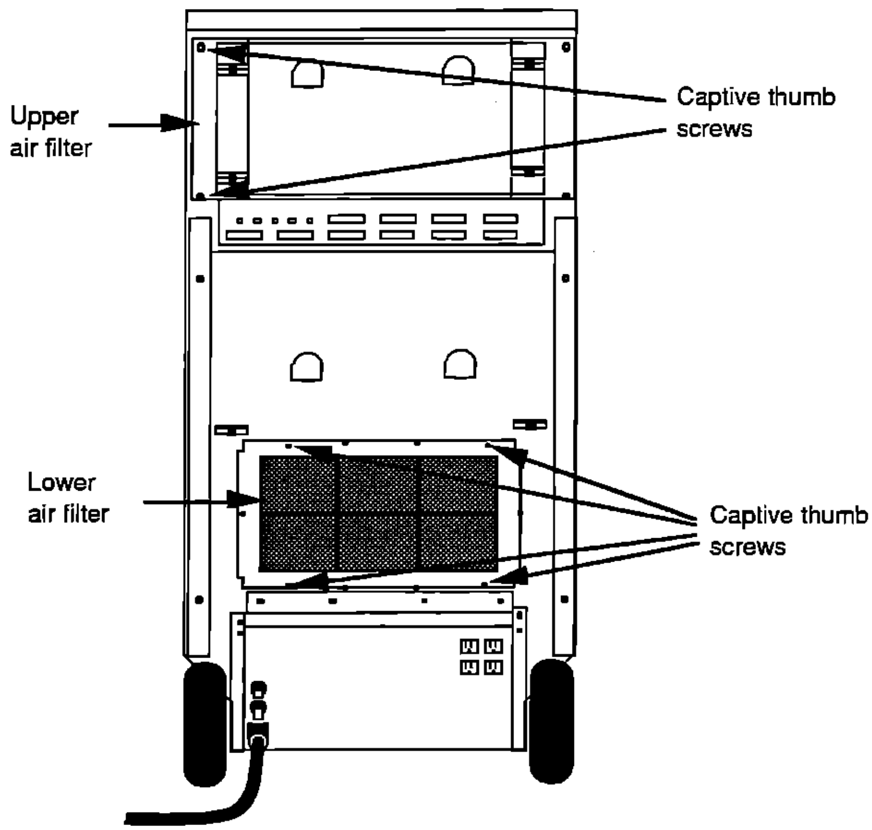

Figure 6-1. Acuson 128XP System Air Filters

- [ ] Carefully vacuum any dust from the system with particular attention to the keyboard, Scanner card cage, Scan Converter card cage and power supply drawer. (Be sure system is unplugged before opening the power supply drawer.)

- [ ] Clean the outside of the system. Use touch-up paint on any scratches. Replace damaged side panels.

Electrical

- [ ] Verify that all recording devices such as VCR's or cameras are connected to one of the isolated outlets on the back of the Acuson 128XP. If these devices are plugged directly into wall outlets, excessive leakage current may create a shock hazard.

- [ ] If a Honeywell or Kowa strip chart recorder (SCR) is installed, verify that it is connected to a 20A dedicated outlet.

- [ ] Verify that the line voltage is within specification (see Power Supply section). Measurements should be within the stated range when the system is both ON and OFF. The system may shut itself down if the line voltage is outside these limits.

- [ ] Verify operation of the cooling fans. Listen for any excessive noise that may be caused by failed bearings.

  - One fan is at the rear of the power supply drawer.
  - Three fans are behind the Scanner card cage.
  - Two fans are on the Scan Converter card cage.
  - Two fans are behind the Scan Converter power supply
  - One fan is behind the Scanner 5V power supply.

☐ Check Scanner power supply voltages. Test points are provided on the DBL. +5 V (digital) should be measured at the DBR. Refer to the table below for test points and proper values.

Power Supplies	Tolerance	Test Point
+5 V (digital)	±0.1 V	DBR J7 Red-Blk
+5 V (analog)	±0.1 V	DBL TP 8
-5 V (derived)	±0.1 V	DBL TP 3
+7.5 V	±0.2 V	DBL TP 7
-7.5 V	±0.2 V	DBL TP 6
+15 V	±0.5 V	DBL TP 9
-15 V	±0.5 V	DBL TP 10
+150 V	±5.0 V	DBL TP 5
Ground reference		DBR J7 pin 2
Ground reference		DBL TP GND

☐ Check Scan Converter power supply voltages. Raise the upper cart. Refer to the table below and Figure 6-2 for measurement points and proper values.

Power Supplies	Tolerance	Test Point
+5 V	±0.1 V	5V Bus Bar
+12 V	±0.3 V	P32 - 12
-12 V	±0.3 V	P32 - 9
Ground reference		Ground bus bar

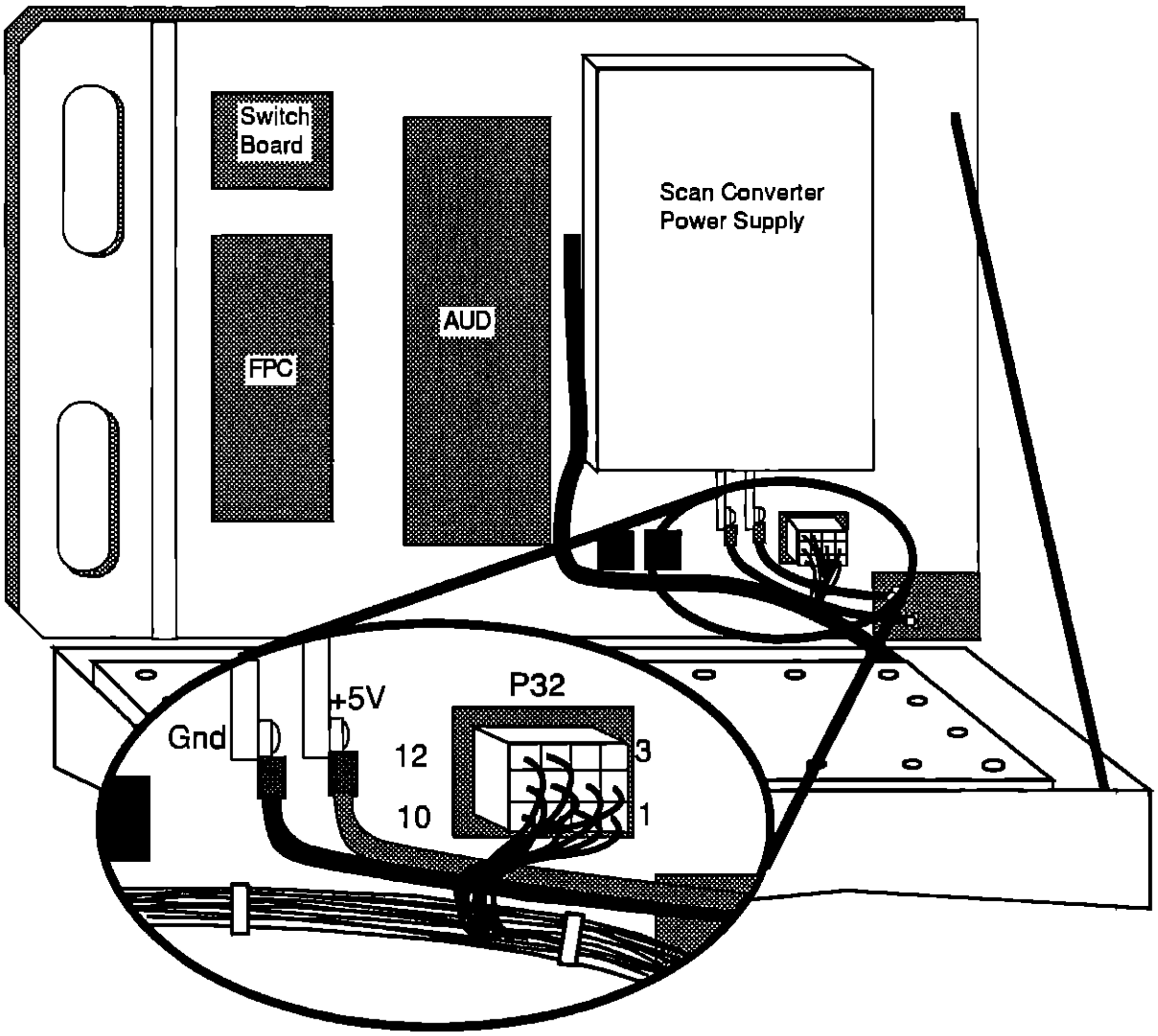

Figure 6-2. Scan Converter Power Supply Measurement Points

Transducer Check

Perform the following checks for each transducer.

Note: The transducer uses a high voltage pulse to generate the ultrasound wave. Damage to the transducer face or cable insulation could cause an electric shock to the patient or sonographer.

- [ ] Inspect the face of the transducer for any nicks, cracks, abrasions or other signs of wear. Replace any transducer which shows damage.

- [ ] Inspect the entire length of the transducer cable for nicks or cuts. Replace any transducer which has an exposed conductor.

- [ ] Image a tissue equivalent phantom with each transducer.

  Document the performance of each transducer.

SECTION 7
Performance Verification

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The following checkout sections assume that the Acuson 128 XP is configured with the GENERAL startup application and no parameters have been modified. For reference, see your user manual.

The Acuson 128XP/E system was designed to emulate the Acuson 128. The XP/E does not have XP capabilities (unless it was field upgraded) and therefore, operates at a different software revision level. Refer to service manual P/N 23151 for a description of the operational tests.

Operational Tests

The following tests provide a means of verifying the performance of the Acuson 128XP and its recording devices. This is meant to be a basic functionality check and most likely will not uncover subtle performance degradation. If problems do arise which are difficult to troubleshoot or are subtle in nature, contact your Acuson Customer Engineer.

Preliminary Setup

- **Select standard Acuson Application:**

1. Turn on the system and wait for the self-test to run. If any errors are reported, refer to sections 2, 3 and 4 and resolve the problem before proceeding.
2. Press CODE + RECALL APPLIC.
3. Press the first soft key to select [ALL] in inverse video.
4. Use the trackball to select the GENERAL Application.
5. Press [RECALL].
6. Verify that the system returns to imaging and that GENERAL is displayed in the data field.
7. The system must remain in this program throughout the verification procedure. If the system is reset or power-cycled, repeat the preceeding steps 1 through 6.

Sector, Linear, Curved and Vector Array Formats

- **To verify sector array format:**

1. Install a sector transducer on the system and verify the following:
   - The sector format is displayed on the monitor.
   - The gray scale containing 16 distinct shades of gray is displayed on the left side of the image.
   - If a radiology application transducer is installed (S228, S519, S5192R, S7146R), the cm (centimeter) scale is displayed on the top and left side of the sector image.
   - If a cardiology application transducer is installed (S2194, S3194, S5192C, S7146C), a row of dots spaced 1 cm apart is displayed on either side of the sector format.
   - The data field displays the following:

     day of month/month/year

     time in hours: minutes: seconds and AM or PM

     transducer type

     frame rate

     scanning depth

     current application: GENERAL

     transmit power in dB

     image processing parameters

     system gain in dB

- **To verify linear array format:**

1. Install a linear array transducer on the system and verify the following:
   - The linear format is displayed on the monitor
   - The gray scale containing 16 distinct shades of gray is displayed on the left side of the image.
   - The cm (centimeter) scale is displayed on the top and left side of the linear image.
   - The data field displays the following:

     day of month/month/year

     time in hours: minutes: seconds and AM or PM

     transducer type

     frame rate

scanning depth
current application: GENERAL
transmit power in dB
image processing parameters
system gain in dB

◆ To verify High Performance Curved Array format:

1. Install a curved array transducer (C544) on the system and verify the following:
   - The curved format is displayed on the monitor
   - The gray scale containing 16 distinct shades of gray is displayed on the left side of the image.
   - The cm (centimeter) scale is displayed on the top and left side of the curved image.
   - The data field displays the following:
     day of month/month/year
     time in hours: minutes: seconds and AM or PM
     transducer type
     frame rate
     scanning depth
     current application: GENERAL
     transmit power in dB
     image processing parameters
     system gain in dB

◆ To verify Vector Array format:

1. Install a Vector Array transducer on the system and verify the following:
   - The Vector Array format is displayed on the monitor
   - The gray scale containing 16 distinct shades of gray is displayed on the left side of the image.
   - The cm (centimeter) scale is displayed on the top and left side of the Vector Array image.
   - The data field displays the following:
     day of month/month/year

time in hours: minutes: seconds and AM or PM
transducer type
frame rate
scanning depth
current application: GENERAL
transmit power in dB
image processing parameters
system gain in dB

System/Monitor Controls

- **To test the Reset button function:**

1. Press RESET. The system should run the self-test routine and then return to normal operation.

- **To test the Contrast control:**

1. Adjust the CONTRAST control located beneath the monitor through its full range.
2. Verify that the contrast increases as the control is turned clockwise and the video is completely off when the control is turned counter-clockwise to its stop.
3. Leave the CONTRAST control in its most counter-clockwise position.

- **To test the Brightness control:**

1. Adjust the BRIGHTNESS control over its complete range.
2. Verify that the intensity of the video increases and decreases as the control is turned.
3. Adjust the BRIGHTNESS to a point where the raster is faintly discernable.
4. Now adjust the CONTRAST control to obtain the desired image. Ensure that all steps in the 16-step gray scale can be seen.

- **To check the monitor:**

1. Verify that the image display field fills the monitor screen. The field should be approximately 167 mm x 125 mm for the 9" monitor, 208 mm x 156 mm for the domestic 12" monitor and 197 mm x 148 mm for the international 12" monitor.
2. Verify that the bottom of the image (linear format) is parallel to the bottom of the monitor.
3. Verify that the display is centered within the monitor bezel and that no video or text characters are occluded by the bezel.

Primary Controls

- **To test the main keyboard:**

1. Press `TEXT` and verify that the following soft-key menu appears

   [TEXT 1] [IMAGE OFF] [HOME SET] [HOME]

2. Press each of the character, text, and number keys and verify that the correct character is displayed on the screen. When the end of each display line is reached, press `RETURN` to start a new line.
3. Press and hold `SHIFT`.
4. Press each of the number and symbol keys to verify that the correct character is displayed on the screen.
4. Press `CODE + DELETE` to erase the characters from the screen.

- **To test the Transmit Zone control:**

1. Connect a transducer.
2. Toggle the `TRANSMIT ZONE` switch down repeatedly.
3. Verify that the transmit zone caret (>) moves down the side of the image as the switch is toggled.
4. For all transducers, verify that multiple carets appear after maximum depth is reached and that a single caret reappears at the top of the image as the switch is repeatedly toggled.

- **To test the Depth control:**

1. Toggle the `DEPTH` switch down repeatedly.

2. Verify that the depth of the image increases and the depth measurement in the data field changes as the switch is toggled.
3. Now toggle the DEPTH switch up.
4. Verify that the depth decreases.

- **To test the Log Compression control:**

1. Toggle the LOG COMP switch down.
2. Verify that the log compression decreases in 1 dB increments.
3. Now toggle the LOG COMP switch up.
4. Verify that the log compression increases in 1 dB increments.

- **To test the Gain control:**

1. Set the transmit power to 0dB.
2. Rotate the GAIN control in both directions, stop to stop.
3. Verify that the overall brightness of the image increases as the control is rotated clockwise and decreases as the control is rotated counter-clockwise.
4. Verify that the total gain change displayed in the data field is 40dB. Minimum and maximum gain should be -20dB and +20dB respectively.

- **To test the DGC controls:**

1. Set transmit power to 0dB and gain to maximum.
2. Move all of the DGC controls to the far left, or minimum setting.
3. Verify that the image is very dark and that the line which represents the DGC curve in the data field is straight and to the far left of the data field.
4. One at a time, beginning with the top, slide each of the eight controls all the way to the right.
5. Verify that as the controls are moved to the right the DGC curve changes to reflect the movement. Also verify that the corresponding section of the image becomes brighter as the control is moved to the right.

To test Three-pot control:

1. Press `CODE + DGC`.
2. Verify that the data field changes to display the following (number values are representative):

   N 20 S 9.9
   D 60 G +16

3. Move the top DGC control to the right and then to the left.
4. Verify that the near field gain in the image increases, the DGC line moves with the control and the value in the N data field increases as the control is moved right and decreases as the control is moved left.
5. Leave the top DGC control in the far right position.
6. Rotate the `GAIN` control both directions, stop to stop.
7. Verify that the value in the G data field increases as the control is turned clockwise and decreases as the control is turned counter-clockwise. (Note: Gain difference may be difficult to detect in the image, as it is dependent on the other controls.)
8. Move the second DGC control right and left.
9. Verify that the slope of the DGC curve decreases as the control is moved left and increases as the control is moved right.
10. Leave the second DGC control in the far right position.
11. Move the third DGC control right and left.
12. Verify that the slope portion of the DGC curve moves up and down as the control is moved left and right.
13. Press `CODE + DGC` to return to eight-pot control.

To test the L/R Invert control

1. Press `L/R INVERT`.
2. Verify that the image is reversed from left to right and all text remains the same except for the □, which should move from the upper left of the image to the upper right.
3. Press `L/R INVERT` again.
4. Verify that the image returns to standard orientation.

◆ To test the U/D Invert control

1. Press U/D INVERT.
2. Verify that the image is reversed from top to bottom and all text remains the same except for the □, which should move from the top of the image area to the bottom.
3. Press U/D INVERT again.
4. Verify that the image returns to standard orientation.

◆ To test the Caliper function

1. Press either CALIPER POS or CALIPER SIZE.
2. Verify that the keycap illuminates and a "+" caliper with a dotted line from the face of the transducer to the caliper position appears on the screen, along with a soft key menu.
3. Use the trackball to move the "+" caliper within the image.
4. Verify that as the caliper is moved within the image, the + Depth=XX mm (linear format) or + Distance from apex=XX mm (sector format) changes to reflect the relative position of the caliper.
5. Press ELLIPSE down and verify the dotted line is removed.
6. Press the other caliper key.
7. Verify that both caliper keycaps are illuminated and a second "+" caliper appears on the screen.
8. Use the trackball to move the second "+" caliper within the image.
9. Verify that as the caliper is moved within the image, the display + Distance = XX mm changes to reflect the distance between the two calipers.
10. Press the [x B CAL] soft key.
11. Verify that the "+" calipers are now frozen and that the "x" calipers are now the active set. Also verify that as the caliper is moved within the image, the x Depth=XX mm (linear format) or x Distance from apex=XX mm (sector format) changes to reflect the relative position of the caliper.
12. Press the other caliper key.
13. Verify that both caliper keycaps are illuminated and a second "x" caliper appears on the screen.
14. Use the trackball to move the second "x" caliper within the image.

15. Verify that as the caliper is moved within the image, the display x Distance = XX mm changes to reflect the distance between the two calipers.
16. Toggle the ELLIPSE switch once, toward the back of the system.
17. Verify that one or more dots appear between the two "x" calipers.
18. Hold the ELLIPSE switch toward the back of the system.
19. Verify that an ellipse is formed, which grows larger as long as the switch is held. Also verify that the size of the ellipse is represented by the following measurements on the screen:

    D1 = XX mm

    D2 = XX mm

    C = XX mm

    A = XX mm^2
20. Press [EXIT] to remove calipers from the screen.

To test the Trace function

1. Press TRACE.
2. Verify that one "+" caliper and the following soft key menu appears.

   [EXIT TRACE] [MARK] [DRAW] [ ]
3. Press [MARK]. Verify the following soft key menu appears:

   [BACK-UP] [MARK] [DRAW] [END TRACE]
4. Move the cursor with the trackball. Note that an "x" cursor remains at the starting point.
5. Repeatedly press [MARK] and move the trackball to draw a curved line of dots on the screen.
6. Press [END TRACE] and verify that area and circumference measurements are displayed.
7. Press [BACK-UP] repeatedly and verify that dots are removed one at a time. Continue until only the "+" cursor remains.
8. Press [DRAW]. Verify that the "x" cursor appears on top of the "+" cursor.
9. Use the trackball to move the cursor and verify that a dotted line is drawn tracing the path of the cursor.
10. Press TRACE. Verify that the drawn line is removed.

- **To test the Tape function**

(only applies if VCR is connected for VCR control)

1. Insert a test tape into the VCR. Press TAPE on the Acuson system.
2. Verify that the PLAY and RECORD buttons on the VCR illuminate and the tape counter on both the VCR and the system increment.
3. Press TAPE again.
4. Verify that the PAUSE button on the VCR illuminates and the tape counter on both the VCR and the system are stopped.
5. Press the rewind button on the VCR and allow the tape to rewind to the beginning of the recording just made.
6. Press PLAYBACK on the system switch panel.
7. Verify that PLAYBACK and TAPE illuminate on the Acuson system.
8. Verify that the display on the monitor changes to what was previously recorded (note time).
9. Press PLAYBACK on the Acuson system.
10. Verify that the STOP button on the VCR illuminates and the tape counter on both the VCR and the system are stopped.

- **To test the Print function:**

1. Press PRINT.
2. Verify that the lenscap illuminates for 2 to 4 seconds and then turns off.

NOTE: You may have to configure your system for a particular hard-copy device. Refer to your user manual for details.

- **To test the RES function:**

(most valuable when used on an imaging phantom)

1. Press RES.
2. Verify that the lenscap illuminates and the soft key menu with POS in inverse video and RES box appear on the screen.
3. Use the trackball to move the RES box to the desired location.
4. Press the [POS/SIZE] soft key so that SIZE is in inverse video. Use the trackball to adjust the size of the RES box.
5. Press RES again.

6. Verify that the area outlined by the RES box is now enlarged and displayed on the screen and that RES appears in the data field.
7. Press RES again.
8. Verify that the lenscap is no longer illuminated, the RES box disappears and the image returns to normal size.

◆ To test the Freeze function

1. Press FREEZE.
2. Verify that the lenscap illuminates and the image freezes (the clock in the upper right of the screen should not increment).
3. Press FREEZE again.
4. Verify that the lenscap is no longer illuminated and the image is returned to real time.

◆ To test the Cine Option function:

(Systems with Cine Option only)

1. Press CINE.
2. Verify that the CINE and FREEZE lenscaps illuminate
3. Verify that the image freezes and that the following soft key menu appears for Imaging Cine memory:

   [SET LEFT]   [SET RIGHT]   [   ]   [REVIEW/STOP]
4. Rotate the trackball in a right to left direction.
5. Verify that the data in the image is updated frame by frame and that the frame number in the data field decrements.
6. Press CINE to exit.
7. Press D PW to obtain one full sweep of strip data.
8. Press CINE.
9. Verify the following soft key menu appears:

   [⇐/⇒]   [   ]   [   ]   [REVIEW/STOP]

10. Rotate the trackball in a right to left direction.
11. Verify that the data in the strip is updated second by second and the number in the data field increments.

12. Press CINE to exit.
13. Verify that the CINE and FREEZE lenscaps are no longer illuminated and that the image is no longer frozen.

- **To test the MultiHertz function:**

(Systems with MultiHertz Option only)

1. Connect a transducer with the MultiHertz feature (C544, S2194, S3194, S5192C, S5192R, S7146C, S7146R)
2. Press MULTIHERTZ.
3. Verify that the MULTIHERTZ lenscap illuminates, and a delta sign appears in inverse video after the transducer type in the data field, indicating that the lower frequency is selected.

- **To test the Left Transducer function:**

(Systems with Transducer Switch Option only)

1. Connect a transducer to the right DL connector.
2. After initialization, connect a transducer to left DL connector.
3. Press LEFT XDCR.
4. Verify that the LEFT XDCR lenscap illuminates and the following message appears:

   INITIALIZING LEFT TRANSDUCER. PLEASE WAIT.
5. Verify that the transducer ID in the data field is that of the transducer in the left transducer port.
6. Press LEFT XDCR.
7. Verify that the LEFT XDCR lenscap is unlit and after initialization the ID of the transducer in the right transducer port appears in the data field.

Secondary Controls

- **To test the Begin function:**

1. Press BEGIN.
2. Verify that the cursor moves to the upper left corner of the screen next to PT:.

◆ To test the Recall Application function:

1. Press CODE + RECALL APPLIC.
2. Verify that the following soft key menu appears with ALL in inverse video:

   [B&W/CD/ALL]   [CATALOG]   [   ]   [RECALL]
3. Verify that by moving the trackball the name of the Application changes in the space after ENTER APPLICATON NAME:.
4. Press CODE + RECALL APPLIC.

◆ To test the Calculation function:

1. Press CALC.
2. Verify a soft key menu for selecting a calculation package appears:

   [OB]   [VASCULAR]   [CARDIAC]   [   ]

◆ To test the CD Capture function:

(Color systems only. Must have color a transducer installed on the system)

1. Press CD CAPT.
2. Verify that the following soft key menu appears:

   [PEAK V]   [   ]   [INTERVAL=1]   [AUTO]
3. Turn the CD LEVEL knob fully clockwise.
4. Press [INTERVAL=1] until it displays [INTERVAL=8].
5. Press [PEAK V].
6. Verify that the image begins to fill with blue, red, green and yellow Doppler noise, and continues to fill for eight seconds, then FREEZE illuminates.
7. Press [PEAK V] again.
8. Verify that the image completely clears and once again begins to fill with Doppler "noise" and FREEZE illuminates.
9. Press CD CAPT to exit.

◆ To test the Fetal Exam function:

1. Press FETAL EXAM.
2. Verify the PWR= in the data field appears in inverse video.

◆ **To test the Transmit Power control:**

1. Press XMTR POWER.
2. Verify that the PWR = section of the data field changes in 3dB steps, to reflect the new transmit power setting each time XMTR POWER is pressed. The available power settings are 0, -3, -6 and -9dB.

◆ **To test the Log Compression function:**

1. Press the LOG COMP keycap.
2. Verify that the following soft key menu appears on the screen:

   [5dB ⇑]   [5dB ⇓]   [1dB ⇑]   [1dB ⇓]

3. Press the first soft key.
4. Verify that each time the key is pressed the log compression level in the data field increments by 5dB until 60dB is reached. The log compression level is located to the left of preprocessing/persistence/ postprocessing:

   50dB A/D/A

5. Press the second soft key.
6. Verify that for each time the key is pressed, the log compression in the data field decrements by 5dB until 30dB is reached.

◆ **To test the Preprocessing function:**

1. Press PRE PROCESS.
2. Verify that for each time the key is pressed, the preprocessing level in the data field increments from 0 to A to B (or 1 to 2 for Radiology). When the highest level is reached, it will wrap around to the lowest level. The preprocessing level is located to the left of persistence/postprocessing in the data field:

   50dB **A**/D/A

◆ **To test the Persistence function:**

1. Press PERSIST.
2. Verify that for each time the key is pressed the preprocessing level (0,A-G for Cardiology, 0, 1-5 for Radiology) in the data field increments. When the highest level, G (5) is reached, it will wrap around to the lowest level. The persistence level is located between preprocessing and postprocessing in the data field:

   50dB A/**D**/A

◆ **To test the Postprocessing function:**

1. Press POST PROCESS.
2. Verify that a soft key menu similar to the one below appears:

   [POST A] [GRAY] [CURVE] [SPECIAL]

3. Press the second soft key until [GRAY] is displayed.
4. Verify that for each time the key is pressed, the postprocessing level (A-G and 0-9) in the data field increments. When the highest level is reached, it will wrap around to the lowest level. The postprocessing level is located to the right of preprocessing/persistence in the data field:

   50dB A/D/A

5. Press the second soft key and verify the B-Color maps (temperature, magenta, and rainbow) are displayed (only on color systems).

◆ **To test the Dual function:**

1. Press DUAL.
2. Verify that the screen format changes from one image to two images; one frozen, one in real-time.
3. Press DUAL-L/DUAL-R.
4. Verify that the frozen image changes to real-time and the real-time image is frozen.
5. Press DUAL.
6. Verify that the screen format changes from two images back to one image.

Customizing Controls

◆ **To test the Store Application function:**

1. Press CODE + STORE APPLIC.
2. Verify that the image disappears from the screen and a list of programs and the following soft key menu appear with ALL in inverse video:

   [B&W/CD/ALL] [PWR-UP] [STORE] [DELETE]

3. Verify that by moving the trackball the inverse bar moves to the next application and the application name is reflected in the space after ENTER APPLICATION NAME:.

- **To test the Invert function:**

1. Press CODE + INVERT.
2. Verify that the following soft key menu appears on the screen:

   [ ] [WHITE/BLACK] [L/R INVERT] [APEX INVERT]
3. Press [WHITE/BLACK].
4. Verify that the background on the screen turns white and all text turns black.
5. Press [L/R INVERT].
6. Verify that the image is reversed from left to right and all text remains the same except for the , which should move from the upper left of the image to the upper right.
7. Press [APEX INVERT] (optional feature).
8. Verify that the image is inverted from top to bottom.

- **To test the Frame Rate function:**

1. Press CODE + FRAME RATE
2. Verify that one of the following soft key menus appear on the screen (Radiology has only [NORMAL] and [SLOW]).

   [56 Hz] [28 Hz] [NORMAL] [SLOW]
3. Press [28 Hz].
4. Verify that the frame rate slows.
5. Press [NORMAL].
6. Verify that the frame rate returns to normal.

- **To test the Scale function:**

1. Press CODE + SCALE.
2. Verify that each time CODE + SCALE is pressed, the scale in the image area changes format.

- **To test the Data function:**

1. Press CODE + DATA.
2. Verify that each time CODE + DATA is pressed, the removable data and DGC curve turn on or off.

- **To test the Date/Time function:**

1. Press CODE + DATE TIME.
2. Verify that the following soft key menu appears on the screen:

   [HOUR] [MINUTE] [SECOND] [DATE]

3. Press [HOUR].
4. Verify that for each time [HOUR] is pressed, the hour increments in the data field.
5. Press [MINUTE].
6. Verify that for each time [MINUTE] is pressed, the minute increments in the data field.
7. Press [SECOND].
8. Verify that for each time [SECOND] is pressed, the seconds in the data field return to zero.
9. Press [DATE].
10. Verify that the following soft key menu appears on the screen:

    [DAY] [MONTH] [YEAR] [TIME]

11. Press [DAY].
12. Verify that for each time [DAY] is pressed, the day increments in the data field.
13. Press [MONTH].
14. Verify that for each time [MONTH] is pressed, the month increments in the data field.
15. Press [YEAR].
16. Verify that for each time [YEAR] is pressed, the year increments in the data field.
17. Press [TIME].
18. Set the correct time and date.

- **To test the Footswitch function:**

1. Press CODE + FOOT SWITCH.
2. Verify that the soft key menu similar to the following appears on the screen:

[ ] [LEFT=PRINT] [RIGHT=FREEZE] [ ]

- **To test the Print Control function:**

1. Press CODE + PRINT CTRL.
2. Verify that the following soft key menu appears on the screen ([SCR-DOP-FRZ] appears only for Cardiology):

   [FRZ-PRT-FRZ] [SCR-DOP-FRZ] [MANUAL] [PRGM DEV]
3. Press [FRZ-PRT-FRZ].
4. Verify that the soft key changes to [FRZ-PRT-RUN].
5. Press [FRZ-PRT-RUN].
6. Verify that it changes back to [FRZ-PRT-FRZ].

- **To test the Freeze Control function:**

1. Press CODE + FREEZE CTRL.
2. Verify that the following soft key menu appears on the screen if in 2-D mode:

   [NORMAL] [HI RES] [ ] [ ]
3. Verify that the following soft key menu appears on the screen if in Doppler or M-mode:

   [M/D-IMMEDIATE] [M/D-END-OF-SWP] [ ] [ ]

- **To test the Tape Counter function:**

1. Press CODE + TAPE CNTR.
2. Verify the following menu appears on the screen:

   VCR COUNTER: 0:00:00

   [ ] [ ] [ZERO] [ENTER]
3. Type 1:11:11 and press [ENTER].
4. Verify the counter setting is in inverse video.
5. Reset counter to previous setting.

- **To test the Screen Control function:**

1. Press CODE + SCREEN CTRL.
2. Verify that the following soft key menu appears on the screen:

[GRAY TEST] [GRAPHICS=HI] [TEXT=HI] [BACKGROUND=OFF]

3. Press [GRAY TEST].
4. Verify a gray test pattern consisting of 16 vertical bars and a 256-shade grade appears on the screen.
5. Press CODE + SCREEN CTRL.

- **To test the Size function:**

1. Press the SIZE toggle down.
2. Verify that the 2-D image changes from full size to reduced size.

- **To test the Application function:**

1. Press the APPLICATION toggle down.
2. Verify that the data field displays the new Application name.

Pulsed Doppler Performance Check

Note: The following checkout sections assume the ability to obtain quality clinical images of different parts of the human anatomy. It may be necessary to enlist the assistance of a qualified sonographer.

- **To verify Pulsed Doppler performance:**

1. Install a linear, curved, sector or Vector Array transducer. Apply coupling gel to the transducer face.
2. Obtain a 2-D image of an area with arterial flow.
3. Press CURSOR and use the trackball to position the Doppler gate within the area of flow.
4. Press D PW.
5. Verify that the screen format changes: the 2-D image should be displayed at the top of the screen and a spectral strip display at the bottom.
6. Verify that a spectral representation of flow within the vessel is present as well as an audio representation (Note: the Doppler gain may need adjusting).
7. Toggle the GATE switch.
8. Verify that the Doppler gate increases in size as the switch is toggled up and decreases as it is toggled down.
9. Toggle the SCALE switch.
10. Verify that the scale increases in range as the switch is toggled up and decreases as it is toggled down.
11. Toggle the BASELINE switch.
12. Verify that the baseline moves downward as it is toggled down and moves upward as the switch is toggled up.
13. Press the SWEEP toggle up and verify the speed increases, and decreases as you toggle down.
14. Press the FILTER toggle up and verify the Doppler data field reflects the change.
15. Rotate the D-GAIN knob clockwise.
16. Verify that both the Doppler signal and background noise (audio and video) increase in intensity.
17. Rotate the D-GAIN knob counter-clockwise.

18. Verify that both signal and noise decrease in intensity.
19. Rotate the VOLUME knob clockwise.
20. Verify that the audio increases in intensity.
21. Freeze the display and press and hold the ANGLE toggle. Verify the angle indicator appears and the Doppler data field shows the angle of correction.

Color Doppler Performance Check

Sector and Vector Array Color

◆ **To verify color Doppler performance on a system with sector and Vector Array color:**

1. Connect a sector or Vector Array transducer capable of color, such as the S228, V328, or S3194. Apply coupling gel to the transducer face.
2. Obtain a 2-D image of an area with arterial flow.
3. Press D COLOR.
4. Verify that the screen format changes: the color bar should appear at the left edge of the screen and a CD RES box should appear in the image area.
5. Verify that the following soft key menu appears on the screen:

   [ ] [CD INVERT] [CD-RES△/▽] [CD-POS/SIZE]

6. Press the [CD-POS/SIZE] soft key to select POS.
7. Using the trackball, verify that you can move the CD RES box so that it is positioned directly over the area of flow.
8. Press the [CD-POS/SIZE] soft key to select SIZE.
7. Using the trackball, verify that you can alter the size of the CD RES box.
10. With the CD RES box positioned over the area of flow, verify the presence of color within the vessel.
11. Toggle the BASELINE switch.
12. Verify that the baseline moves down within the color bar as it is toggled toward you and moves up as the switch is toggled away. Verify that as the baseline moves, the color in the image changes.

13. Rotate the CD LEVEL knob clockwise.
14. Verify that the amount of color in the image increases.
15. Rotate the CD LEVEL knob counter-clockwise.
14. Verify that the amount of color in the image decreases.

Linear Color

- **To verify color Doppler performance on a system with Linear Color:**

1. Connect a linear transducer capable of color, such as the L538 or L7384. Apply coupling gel to the transducer face.
2. Obtain a 2-D image of an area with arterial flow.
3. Press D COLOR.
4. Verify that the screen format changes: the color bar should appear at the left edge of the screen and a color box should appear in the image area.
5. Verify that the following soft key menu appears on the screen:

   [ANGLE L/C/R] [CD INVERT] [CD-RES]
6. Press the [ANGLE L/C/R] to select color box angle

   Note: steering angle is not adjustable on all transducers.
7. Verify that as you press the soft key, the color box will alternately angle left, center and right.
8. Press the [CD INVERT] soft key.
9. Verify that the color bar inverts when the soft key is pressed.
10. With the CD RES box positioned over the area of flow, verify the presence of color within the vessel.
11. Toggle the BASELINE switch.
12. Verify that the baseline moves down within the color bar as it is toggled toward you and moves up as the switch is toggled away. Verify that as the baseline moves, the color in the image changes.
13. Rotate the CD LEVEL knob clockwise.
14. Verify that the amount of color in the image increases.

15. Rotate the CD LEVEL knob counter-clockwise.
16. Verify that the amount of color in the image decreases.

Auxiliary CW Doppler Performance Check

◆ **To verify Auxiliary CW Doppler performance:**

1. Connect the AUX CW transducer.
2. Apply coupling gel to the face of the transducer.
3. Press the AUX CW lenscap on the keyboard.
4. Verify that a strip display appears on the screen.
5. Measure the velocity of flow within the ascending aorta, descending aorta or inferior vena cava.
6. Verify that a spectral representation of flow appears in the spectral strip.
7. Toggle the SCALE switch.
8. Verify that the scale increases in range as the switch is toggled away from you and decreases as it is toggled toward you.
9. Toggle the BASELINE switch.
10. Verify that the baseline moves down as it is toggled toward you and moves up as the switch is toggled away.
11. Rotate the D-GAIN clockwise.
12. Verify that both the Doppler signal and background noise (audio and spectral strip) increase in intensity.
13. Rotate the D-GAIN counter-clockwise.
14. Verify that both the Doppler signal and background noise (audio and spectral strip) decrease in intensity.

M-mode Performance Check

◆ **To verify M-mode performance:**

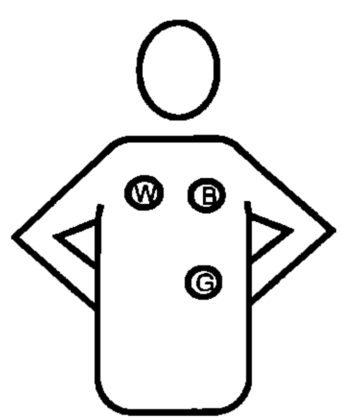
1. Connect a cardiac application sector transducer. Apply coupling gel to the transducer face.

2. Obtain a 2-D image of the heart with valve motion.
3. Press CURSOR and use the trackball to position the M-mode cursor through the area of valve motion.
4. Press M MODE.
5. Verify that the screen format changes: the 2-D image should be displayed at the top of the screen and an M-mode strip at the bottom.
6. Verify that a graphic representation of the valve motion is present.
7. Rotate the inner GAIN knob and verify that only the M-mode gain increases as you rotate clockwise and decreases as you rotate counter-clockwise.
8. Press M MODE to exit.
9. Press D COLOR.
10. Obtain a 2-D color image of the heart.
11. Press CURSOR.
12. Position the cursor over the area of valve motion.
13. Press M MODE.
14. Press UPDATE.
15. Verify a color M-mode strip appears.

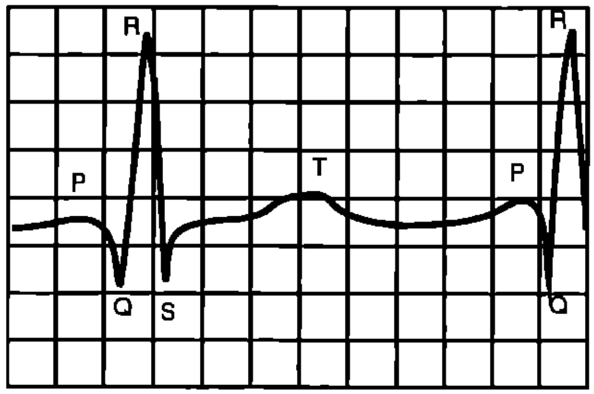
ECG and Physio Module Performance Check

- **To verify ECG module performance:**

1. Plug the ECG cable into the ECG module.
2. Stick the ECG adhesive electrodes to yourself as shown.



3. Attach the patient leads to the electrodes.
4. Connect the patient leads to the ECG cable.
5. Switch the STD-OFF-MON paddle to STD.
6. Turn the gain knob fully counter-clockwise to AUTO.
7. Verify that your cardiac cycles are displayed on the monitor after 3 cardiac cycles have elapsed.



8. Press `CODE + R BEEPER` and verify that a "beep" occurs at each R wave.
9. Press `TRIG 1` and use the trackball to position the trigger point on the first R wave. Verify the 2-D image updates at each R wave.
10. Press `D-PULSE` or `M-MODE`.
11. Verify that the position of the trace varies on the screen while adjusting the POS knob.
12. Select AUX on the ECG. Verify that a second trace appears. Adjust the AUX position knob and verify that the position of the AUX trace on the screen varies.

◆ To verify Physiologic module performance:

1. Set the filter selector switch to one of the five filter settings (.5-1 through .3-8). Verify that a trace appears on the screen.
2. Press `M-MODE` on the Acuson system and vary the POS control next to the Phono jack on the Physio Module. Verify that the trace moves up and down on the strip.
3. Plug a heartsound transducer into the input marked Phono.
4. Plug in the headphones and place them over your ears.

4. Plug in the headphones and place them over your ears.
5. Tap on the transducer, or spread a thin film of petroleum jelly (not ultrasound gel) around the perimeter of the transducer face and position the transducer near your heart. Verify that you hear a signal. Also look for a response on the trace. Adjust the GAIN to vary the amplitude of the response.
6. Remove the heartsound transducer and headphones. Select P with Pulse/Respiration input selector knob.
7. Plug the pulse transducer into the Pulse/A input jack.
8. Tap on the pulse transducer, or place the transducer (with a bell attached) where you can feel your pulse. Verify that the trace is present and that it responds to the GAIN and POS knobs.
9. Remove the pulse transducer.
10. Move the Pulse/Respiration input selector to R and plug the nasal thermistor transducer into the Resp/B input jack.
11. Hold the transducer in front of your mouth or nose. Verify a trace is present and it responds to your breathing. Verify the trace responds to the GAIN and POS knobs.
12. Move the Pulse/Respiration input selector to A and verify that a trace is present and that it responds to the GAIN and POS knobs.

OEM Peripheral Performance Checks

VCR - Panasonic 6300 VHS and 7300 S-VHS

◆ **To verify proper operation of the Panasonic 6300 VHS or 7300 S-VHS VCR:**

1. Turn on the VCR and insert a blank tape.
2. Press TAPE on the Acuson keyboard.
3. Verify that the tape counter on the VCR begins to increment (note starting number) and that the tape begins to move.
4. Press D PW on the Acuson keyboard (Doppler systems only). Note: refer to the "Doppler Mode - Selecting Audio Channels" section of your user manual.

5. Rotate the D GAIN knob in a clockwise direction until audio is present on the speakers of the Acuson 128XP.
6. Verify that the needles in the VCR audio meters move in conjunction with the audio from the speakers of the system.
7. Press TAPE on the Acuson keyboard.
8. Verify that the tape in the VCR stops moving.
9. Press REWIND on the VCR front panel.
10. Allow the VCR to rewind the tape to the point on the tape counter at which you began recording.
11. Press STOP on the VCR front panel.
12. Press PLAYBACK on the Acuson keyboard.
13. Verify that the video and audio that were previously recorded are played back on the Acuson monitor and speakers.

IIE Multi-Format Camera

◆ **To verify proper operation of the IIE Multi-Format Camera:**

1. Install the multi-image camera as the default print device on the Acuson 128XP using CODE + PRINT CTRL.
2. Insert a film cassette loaded with unexposed film into the camera.
3. Remove the dark slide from the cassette.
4. Obtain a 2-D image on the Acuson.
5. Press FREEZE on the Acuson keyboard.
6. Press PRINT on the Acuson keyboard.
7. Verify that the green LED on the camera front panel which represents the first frame turns red.
8. Expose all six frames (or nine frames for 9-on-1 format).
9. Verify that, after the last frame is exposed, all of the LED's are red.
10. Reinsert the dark slide, remove the cassette and develop film.
11. Verify that the contrast and brightness match those on the Acuson monitor.
12. To make adjustments see your IIE owner's manual.

Matrix Multi-Format Camera

◆ **To verify proper operation of the Matrix Multi-Format Camerai.cameras;:**

1. Install the multi-image camera as the default print device on the Acuson 128XP using CODE + PRINT CTRL.
2. Insert a film cassette loaded with unexposed film into the camera.
3. Remove the dark slide from the cassette.
4. Verify that the camera displays #DR on the LED's, that the cassette slides into the camera and that the camera then displays #1.
5. Obtain a 2-D image on the Acuson.
6. Press FREEZE on the Acuson keyboard.
7. Press PRINT on the Acuson keyboard.
8. Verify that the camera displays #EXP, beeps, then displays the next frame number.
9. Expose all six frames (or nine frames for 9-on-1 format).
10. Verify that after the last frame is exposed, the camera displays #END and ejects the cassette.
11. Reinsert the dark slide, remove the cassette and develop film.
12. Verify that the contrast and brightness match those on the Acuson monitor.
13. To make adjustments see your Matrix owner's manual.

Color Page Printer - Sony UP-3000 or Sony UP-5050W

◆ **To verify proper operation of the Sony-UP 3000 or UP-5050W Color Page Printer:**

1. Verify that the printer is loaded with paper and ribbon.
2. Obtain a 2-D or Color image on the Acuson 128XP.
3. Press FREEZE on the Acuson keyboard.
4. Press MEMORY IN on the Sony remote control.
5. Press PRINT on the Sony remote control.

6. Verify that a linear color bar is correctly recorded on the print and that the image is centered on the paper.
7. To make adjustments see your Sony Page Printer user's manual.

Strip Chart Recorder - Honeywell LS-85 or KOWA TLR 111

- **To verify proper operation of the Honeywell LS-85 or KOWA TLR 111 Strip Chart Recorder:**

1. Load paper into the dry silver transport of the Honeywell strip chart recorder or in the paper supply of the KOWA strip chart recorder.
2. Install the strip chart recorder as the default print device on the Acuson 128XP using `CODE + PRINT CTRL`.
3. Press `FREEZE` on the Acuson keyboard.
4. Press `PRINT` on the Acuson keyboard.
5. Verify that the strip chart recorder provides a screen print of the frozen image on the Acuson video.
6. Verify that the image on the paper closely represents the brightness, contrast and gray scale of the image on the Acuson video.
7. To make adjustments see your strip chart recorder manual.
8. Press `FREEZE` again to unfreeze the image.
9. Press `M-MODE` on the Acuson keyboard (on systems which have M-mode)
10. Press `PRINT` on the Acuson keyboard.
11. Verify that the strip chart recorder provides a strip display of the M-mode strip.
12. Verify that the image on the paper closely represents the brightness and contrast of the image on the Acuson video.
13. To make adjustments see your strip chart recorder manual.

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Assemblies

25636	ASSY, 9" MONITOR BEZEL,B/W XP
24934	ASSY, 10" MONITOR BEZEL, XP
24933	ASSY, 12" MONITOR BEZEL, XP
22480	ASSY, B/W I/O PNL, 115V XP
24990	ASSY, B/W I/O PNL, 220V XP
23905	ASSY, BAFFLE/FAN DRVR, PH 2B
16781	ASSY, BLEEDER FCI FILT INT'L
16776	ASSY, BLEEDER FCI FILT, LPS R-PNL
22483	ASSY, CDI I/O PNL, 115V XP
24993	ASSY, CDI I/O PNL, 220V XP
24580	ASSY, ECG MODULE XP
22486	ASSY, FAN PNL, PH2B
24207	ASSY, KYBD TRIM & SW, CDI, XP
24209	ASSY, KYBD TRIM & SW, CVS, XP
25233	ASSY, KYBD TRIM & SW, CVS,BKLT
24208	ASSY, KYBD TRIM & SW, R-D, XP
25619	ASSY, KYBD, B/W CVS, XP
22481	ASSY, LPS-TRAY, 220V, PH2B
21092	ASSY, REMOTE TEMP SENSOR XP
24936	ASSY, SCAN CONVERTER, (no PCBs)
24346	ASSY, SPEAKER, XP
24062	ASSY, STORAGE BKT, XP
25637	ASSY,12" MONITOR BEZEL, B/W, XP
25475	KYBD TRIM PLATE ASSY,CVS XP UP
25476	KYBD TRIM PLATE ASSY,RAD XP UP
25843	KYBD TRIM PLATE ASSY,RAD XP NONCC

Cables and Wire Harnesses

Cable Assemblies

26096	ADAPTER, SONY RMT PRNT TO BNC
16801	ASSY, TRACKBALL WIRE HARNESS
11178	CABLE ASSY & FOOT SWITCH
19780	CABLE ASSY, AUDIO HEADPHONE ST
20751	CABLE ASSY, AUDIO IN ADAPTER
14536	CABLE ASSY, DOPPLR DIGITAL BUS
18326	CABLE ASSY, FOOT SWITCH CVS/FLW
24156	CABLE ASSY, FPC TO CSI
14535	CABLE ASSY, IC II RMT PORT INT
24155	CABLE ASSY, MON BZL INTCT, XP
23868	CABLE ASSY, PADDLE SWITCH V
21231	CABLE ASSY, PROBE TEMP INTCI
24829	CABLE ASSY, REMOTE PRINT-64"
16538	CABLE ASSY, SCAN PANEL-DCP,SCM
25043	CABLE ASSY, SCNR GRND, 4.5"
25042	CABLE ASSY, SCNR GRND, 6.5"
18050	CABLE ASSY,PRINTER INTRFACE FLOW
16815	CABLE, 6' AUDIO PHONO-PHONO, ECG
24406	CABLE, 14 POS DIP JUMPER, PCB ASSY, LED DISPLAY BOARD
10785	CABLE, SAFETY, UPPER CART MECHANICAL STOP
11122	COAX CABLE ASSY, M-I CAMERA
23253	CORD, MAIN AC POWER , 15A, 15FT
25745	CORD, MAIN AC POWER, 20A,15FT
25994	HARNESS, AUDIO AMP TO MCB3
25350	HARNESS, AUDIO VOL POT, BKLT
24157	HARNESS, AUX CW PREAMP, XP
25617	HARNESS, D-GAIN POT, BKLT
25349	HARNESS, DOP/CD LEVEL POT, BLKT
18223	HARNESS, HANDLE LAMPS (FLOW)
24158	HARNESS, HEADPHONE, XP
19297	HARNESS, HV BUS TO PDB II
18322	HARNESS, ISO-AC TO RFI
18773	HARNESS, ISO-AC TO TRAY, INTL
20392	HARNESS, ISO-AC, 115V PH2B
22537	HARNESS, ISO-AC, 220V PH2B
25009	HARNESS, MICROPHONE, XP

24159	HARNESS, MON CNTRL PWR, XP
19913	HARNESS, MON TO MCP, CVS
20393	HARNESS, NON-ISO, 115V PH2B
22536	HARNESS, NON-ISO, 220V PH2B
17839	HARNESS, ROCKER SW/PDB, PH2
17112	HARNESS, SC HI CURRENT 5 V
17111	HARNESS, SC HI CURRENT RETURN
18856	HARNESS, SCANNER FAN DRIVER
17113	HARNESS, SCANR 5 V HI CURRENT
17191	HARNESS, SOFTSTART TO PDB
17193	HARNESS, SOFTSTART TO TERM BLK
24233	HARNESS, SYS PWR, DC, PH2B/XP
25413	KIT, GROUNDING, BEZEL 128XP

Flat Ribbon

16537	CABLE ASSY, ECG - SCAN PANEL
14851	CABLE ASSY, FPCII TO PADDLEBD
11118	CABLE ASSY, GAIN CONTROL PANEL
18037	CABLE ASSY, INTRCHAS J4 FLOW
18036	CABLE ASSY, INTRCHAS J5 FLOW
18038	CABLE ASSY, INTRCHAS J6 FLOW
18039	CABLE ASSY, INTRCHAS J20 FLOW
20228	CABLE ASSY, RMT PORT INT, COLOR
18035	CABLE ASSY, S.C.-FPC II FLOW
25375	CABLE ASSY, SERIAL PORT
18051	CABLE ASSY, SI-AUDIO PROC FLOW

High Speed Coax

17970	CABLE ASSY, COMPON REC, FLOW
18331	CABLE ASSY, CSI/MON, CVS
17962	CABLE ASSY, MIC REM,INT,(FLOW)
17966	CABLE ASSY, MON-AUX (FLOW)
17968	CABLE ASSY, SCR (FLOW)

17964	CABLE ASSY, VCR INTF (FLOW)
21617	CABLE ASSY, VIDEO IN/OUT
17965	CABLE ASSY, VIDEO PERIPH, FLOW
17963	CABLE ASSY,COMPOSITE VID, FLOW
24150	CABLE AUX RGB S/M, GREY
24151	CABLE RGB CAM S/M, GREY
24148	CABLE VCR PANA S/M, GREY

Fans

16891	FAN, 3 5/8-INCH 24 VOLT, ASSY, LOWR PH2B
18480	FAN, 6 INCH, 12 VOLT, W/TACH ASSY, FAN PNL ASSY, LPS R-PNL ASSY, SCANNER CHASSIS
11521	FAN, 148VP-282, KIT, UPGD, SCANNER CHASSIS,XP
11553	FINGER GUARD, 6" FAN
17114	FINGER GUARD, SMALL 3.13, LOWR CART PS

Filters, Air

22341	FILTER, BACK, LC, PH2B
11982	FILTER, MESH
23849	FILTER, PLENUM, RT, UC, XP

Foam and Rubber

19629	BAFFLE, SPEAKER
25540	FOAM PAD, SPEAKER HOUSING
11761	FOAM, CHASSIS INSULATING
26036	FOAM, ECG/HPR REROFIT
18497	FOAM, SC COVER II (FLOW)
16387	GROMMET, 1/8 IN ID 11/32 OD, HARNESS, MONITOR/LAMP
19884	INSULATOR, 12" COLOR MONITOR
24427	MAT, STORAGE COMPARTMENT XP
21032	PANEL, SIDE INSULATION
12342	SOUNDPROOFING, LOWER CART 1" THK
23064	SOUNDPROOFING, LOWER CART 1/2" THK
18239	SOUNDPROOFING, PWR SUP INTAKE
23063	SOUNDPROOFING, WHEEL WELL 1/2" THK

Hardware, Electrical

24624	ADAPTOR, BNC 75-0 BLKHD F-F N-ISO, I/O PNL
11107	BATTERY, LITHIUM, VC AND CVC
11903	CABLE TIE 1 1/4
11720	CABLE TIE, 1.5 DIA
17582	CABLE TIE, 2 INCH DIA
11721	CABLE TIE, 3/4 DIA
17190	CABLE TIE, MARKER
20750	CABLE, PHONO JACK-JACK, CABLE ASSY, AUDIO IN ADAPTER
17084	CLAMP TIE, #10
20695	CLAMP, CABLE, 1/8 in NYLON, ASSY, UPPER CART
17809	CLAMP, CABLE,3/4,#10 SCR,NYLON
11885	CLAMP,CABLE,3/16 #10 SCR, NYLON
18479	CONNECTOR, BNC FEED-THRU, F-F, ISO, I/O PNL
11787	FAN CORD, MOLDED DAISY CHAIN, KIT, UPGD, SCANNER CHASSIS,XP
18022	FRAME, SNAP-IN SWITCH MOUNTING, PCB ASSY MONTR CNTL
16366	FUSE BLOCK, 3AG, HARNESS, MONITOR/LAMP
10927	HEAT SINK 6070, PCB ASSY MONTR CNTL
10838	JUMPER, SUITCASE, 2-POS -- USED ON VARIOUS PCBs
25208	LAMP, FUSE, 6V/.1A, ASSY, UPPER CART
21264	LAMP, INCANDSCNT, T1 18V, .5W, PCB ASSY,LSB2
17566	LOCKING POST ASSY, ASSY,CARD TRIM PLATE & SWITCHES
17254	MICROPHONE (part of 25009 microphone harness)
23758	NUT, MOUNTING EAO PUSH-BUTTON, PCB ASSY SW BD PCB ASSY FPC PCB ASSY LIGHTED SWITCH BD
18475	PLUG, 3.5 MM STEREO PHONE, ADAPTER, SONY RMT PRNT TO BNC
11334	POT C 250 5/8" ROTRY LIN CRMT MONITOR CONTROL BOARD
11524	POT D 1K 5/8" ROTRY LIN COMP MONITOR CONTROL BOARD
14531	POT E 10K 5/8" ROTRY LIN CRMT MONITOR CONTROL BOARD
11262	POT E 10K 60MM SLIDE LIN PCB ASSY DGC III
24487	POT E 10K DUAL CONCEN HARNESS, DOP/CD LEVEL POT, BKLT
23948	POT E 10K DUAL CONCENTRIC, HARNESS, DOP/CD LEVEL POT
25622	POT E 10K X 1, BL KBD 1.0 SHFT, HARNESS, D-GAIN POT, BKLT
24486	POT E 10K X 3, BL KBD, HARNESS, AUDIO VOL POT, BKLT
11523	POT F 100K 5/8" ROTRY LIN COMP, MONITOR CONTROL BOARD
11849	SHIELDING STRIP, EMI,.760 LEAF, ASSY, LOWER CART
17078	SPEAKER 3.5" SHIELDED (part of 24346 speaker assy)
14598	TERM SPLICE BUTT 22-16AWG
13753	TIE MOUNT, CABLE

Hardware, Mechanical

24060	ASSY, DRESS PNL, LF, XP
24061	ASSY, DRESS PNL, RT, XP
14516	BUSHING WHEEL
12750	CABLE CLAMP, CUSHIONED METAL, ASSY, LPS-TRAY
12595	CABLE MOUNT, FLAT
17645	CABLE MOUNT, PURSE LOCK, 1.00"
24205	CASTER, SWIVEL AND BRAKE,XP
24341	CLIP, SNAP-IN
14995	EDGING, STORAGE BIN
26097	FOOT, POLYASTOMER, BLK .75DIA, SONY UP-3000 COLOR PRINTER
11988	KNOB, THUMB SCR #8 ALN CAP BLK
11792	MOUNT, CABLE-TIE, 1 INCH SQ.
11791	MOUNT, CABLE-TIE, 3/4 INCH SQ.
16419	PLASTIC INSERT, EDGE, ASSY,SCANNER CHASSIS
24994	PLUG, HOLE, .375, WHT NYLON
24991	PLUG, HOLE, .687, WHT NYLON
12035	PLUG, SNAP-IN
16399	PLUG, SNAP-IN 3/8"
11134	SCREW-LOCK KIT, D-SUBMIN
25020	SET SCREW, 6-32x3/16" S/S CUP, UPPER CART
22614	SHIELDING STRIP, F/R, UC TO LC
24390	SHIELDING, EMI SCNR 6" L X.25"
24391	SHIELDING, EMI SCNR 17."L X.25" H
24189	SHIELDING, EMI STRG BKT 13.4LX.125T
24188	SHIELDING, EMI,DRS PNL,3.5L x.125T
24186	SHIELDING, EMI,DRS PNL,12.5L x.25T
24187	SHIELDING, EMI,DRS PNL,21L x .25T
19576	SHIELDING, UC CVR, FRONT/REAR
19575	SHIELDING, UC CVR, SIDE (REAR)
22261	SHIELDING, UC CVR,SIDE (FRONT)
22260	SHIELDING, UC TO LC, RT SIDE
12944	SLIDES, LPS LEFT AND RIGHT
21687	STANDOFF, .5" NYLON SNAP-IN, PCB ASSY HV BUS WARN INDICATE
24539	STRAIN RLF, PCC CORD .55-.71, POWER CORD, DOMESTIC
14515	WHEEL , 8" OFFSET HUB

Labels

21259	LABEL, 100 MICROAMP RISK CURNT
21762	LABEL, ACC OUTLET
24766	LABEL, CB2-ISO ACC OUTLET,INTL
14032	LABEL, CKT BKR CB1 BRIT "MAINS"
12621	LABEL, COAX
16833	LABEL, COAX J12
12526	LABEL, COAX VIDEO IN
17598	LABEL, COAX, REMOTE PRINT
25445	LABEL, COLOR KYBD, XP UPGRADE
25744	LABEL, CONN. RCPT, JAPAN
12373	LABEL, CONTROL ACCESS
24557	LABEL, CONV RECPT-ISO, INTL
11533	LABEL, FOOT SWITCH
20205	LABEL, INTL ANESTHETIC GAS
20209	LABEL, INTL I/O LEAKAGE
20210	LABEL, INTL SERIAL NO
25446	LABEL, KYBD, ELLIPSE, XP UPGD
24553	LABEL, MNTR CNTL III B/W DOP
24556	LABEL, MNTR CNTL III COLOR
18320	LABEL, PHASE II PWR SPLY WRNG
12377	LABEL, POWER INPUT
14033	LABEL, PROT EARTH SYMBOL, EURO
17800	LABEL, RECEIVER, BNC
21567	LABEL, RFI FILTER MTG(PER CSA)
21763	LABEL, SPEC
17727	LABEL, SYSTEM POWER CABLE
17271	LABEL, TERMINAL BLK 1
17941	LABEL, TERMINAL BLK 1, INT'L
17272	LABEL, TERMINAL BLK 2
17940	LABEL, TERMINAL BLK 2, INT'L
17801	LABEL, TRANSMITTER, BNC
16452	LABEL, U.S. PATENT NUMBER
18535	LABEL, WARNING, PPS HEATSINK
17431	LABEL, "X-RAY" GERMAN
25529	NAMEPLATE,ACUSON 128 XP/10
25528	NAMEPLATE,ACUSON 128 XP/5

Manuals and Video Tapes

128XP Manuals

25224	Radiology and Vascular Applications User Manual
25225	Cardiovascular Applications User Manual

128/5 and 128/10 Manuals and Video Tapes

26058	CUSTOMER UPG VIDEO 128/10 DOM
26059	CUSTOMER UPG VIDEO 128/10 INTL
25971	Cardiovascular Applications User Manual
25970	Radiology and Vascular Applications User Manual

Monitors

19806E	MONITOR, TSTD 9" B&W INT'L
19801T	MONITOR, TSTD 9" B&W USA
17728E	MONITOR, TSTD 9" COLOR INT'L
17728T	MONITOR, TSTD 9" COLOR USA
18118E	MONITOR, TSTD 12" B&W INT'L
18118T	MONITOR, TSTD 12" B&W USA
18799E	MONITOR, TSTD 12" COLOR INT'L
18799T	MONITOR, TSTD 12" COLOR USA

OEM Devices and Accessories

Devices

24793	CAMERA, IIE MP4000, 6-1 , DOM
24771	CAMERA, IIE MP4000, 6-1 , INT'L
24791	CAMERA, IIE MP4000, 9-1 , DOM
12530	CAMERA, MATRIX 1010 6-1, DOM
19510	CAMERA, MATRIX 1010 6-1, INT'L
12765	CAMERA, MATRIX 1010 9-1
25621T	PRINTER, COLOR, TSTD SONY 3000
21066T	PRINTER, COLOR, TSTD SONY 5050W
24550	SCR, KOWA, DOM
24551	SCR, KOWA, INT'L

20070	VCR,PANASONIC AG 7300 SUPER VHS

Accessories

21667	ASSY, PAGE PRINTER/VCR MATING
21595	COVER, REMOTE CONTROL, SONY
14442	HEADPHONES & STEREO PLUG ADAPT
19836	KIT, ECG LEADS
21772	KIT, VELCRO, REMOTE CNTRL,SONY
12543	MICROPHONE, ELECTRET STEREO
21686	SLIDE LOCK, PAGE PRINTER/VCR

Metal Parts

23738	BAFFLE, LF, SCANNER,XP
23739	BAFFLE, RT,SCANNER,XP
23669	BLOCK, PIVOT, VIDEO DOOR, XP
25641	BRACKET, DUAL POT,NON-CC RTRFT XP
25639	BRACKET, LT,FPC,NON-CC RTRFT,XP
25640	BRACKET, RT,FPC,NON-CC RTRFT, XP
24460	BRACKET, SOFTKEY SWITCH, 9" XP
23668	BRACKET, SOFTKEY SWITCH, 12" XP
24537	BRACKET, STRG BKT LATCH, MAGNETIC
23671	BRACKET, VIDEO DOOR, XP
16363	BUSHING, STORAGE BIN
24136	CHASSIS, KEYBOARD RETROFIT,XP
24469	CHASSIS, KYBD BZL, BACKLITE
17077	COVER, I/O CONN PCB (SCC) FLOW
19441	COVER, SC 5V PS PH2
22253	COVER, SCC, PH2B
25658	COVER, SERIAL PORT
22266	COVER, UC FILTER, PH2B
22267	EXTENSION, UC REAR PANEL, PH2B
19327	FASTENER, MONITOR SUPPORT
24790	FLIP-OUT, TRANSDUCER RTRFT, XP
23760	FLIP-OUT, TRANSDUCER, XP
14886	FLOW STRAIGHTENER, HONEYCOMB,II
23805	FOOT REST, LOWR CART, XP
16341	GROUNDING BLOCK, DL
16581	GROUNDING STRIP,MOD,TOP COVER
25989	HOLSTER, BKT, XDCR, XP, II

24343	HOOK, REAR CORDAGE
25068	HOOK, XDCR CORDAGE
19572	MTG BRKT, 9" COLOR I/O BOARD
19804	MTG BRKT, 12" COLOR I/O BOARD
23545	MTG PLATE, THERMAL SENSOR, XP
19434	PAN, MONITOR, 10" B/W
24204	PANEL COMPARTMENT, REAR, XP
25630	PANEL, B/W I/O, XP
24057	PANEL, CDI I/O, XP
23922	PANEL, FRONT BLANK, XP
23877	PANEL, FRONT, ECG, XP
24707	PANEL, MON CNTRL, XP
24708	PANEL, SAFETY, MON CNTRL XP
13452	PIN, LOAD BEARING, LOWER CART
11940	PIN, LOCKING
19839	PLATE, COVER PHYSIO II
25357	PLATE, HUBCAP MOUNTING
23762	PLUNGER BLOCK, XDCR FLP-OUT,XP
10981	POWER BUS, SCANNER
17479	REFLECTOR, LAMP (FLOW)
23925	REFLECTOR, LAMP, MON BZL, XP
23759	RETAINER, XDCR FLIP-OUT, XP
10982	RETURN BUS, SCANNER
21158	SHIELD, FPC BOARD
23930	SHIELD, S5V P.S. II
19326	SUPPORT, MONITOR BASE II
17054	TOP COVER, S5V P.S.
20380	TRIMPLATE, KEYBOARD, B/W FRENCH
20381	TRIMPLATE, KEYBOARD, COLOR, FR
25644	TRIMPLATE, KEYBOARD, NON-CC RTRFT,XP
25609	WASHER, SHOULDER, SINGLE POT
23593	WELD'T LOWR CART, XP
23864	WELD'T, BUCKET, AUX CW, XP
25993	WELD'T, BUCKET, XDCR, XP, II
23663	WELD'T, STORAGE BKT, LC, XP
23620	WELD'T, TOP CVR, XP

Plastic Parts

23551	ACTUATOR, SOFTKEY, XP
25737	BEZEL, KEYBOARD, B/W, XP
24468	BEZEL, KEYBOARD, BACKLITE
23667	BEZEL, KEYBOARD, COLOR, XP
21463	BEZEL, MONITOR, 12" FRENCH
20278	BEZEL, MONITOR, FLOW (FRENCH)
25634	BEZEL, MONITOR, W/9"B/W INSERT,XP
25059	BEZEL, MONITOR, W/10"CLR INSERT,XP
25635	BEZEL, MONITOR, W/12"B/W INSERT.XP
25060	BEZEL, MONITOR, W/12"CLR INSERT,XP
23556	CAP, DGC SLIDE POT, XP
17899	DIFFUSER, DASH HANDLE (FLOW)
23921	DIFFUSER, LAMP, MON BZL,XP
23541	DOOR, VIDEO, XP
23532	FACEPLATE, DL STORAGE, XP
11879	GROMMET EDGING, CATERPILLAR
24202	HOLSTER, BKT, AUX CW, XP
24052	HUBCAP, REAR, "ACUSON"
23741	SHIELD, MICROPHONE, XP

Power Supplies

Assemblies

18782T	ASSY, TSTD FDB
18542T	ASSY, TSTD PDB 2, DOM
18542TI	ASSY, TSTD PDB 2, INT'L
16871T	ASSY, TSTD PPS PH2
17844T	P.S., SCAN CONV 24V MOD TESTED
18923T	P.S., SNR ANALOG LW RIPPLE TESTED
18924T	P.S., SNR DIGITAL LW RIPPLE TESTED

Circuit Breakers

22932	CIRCUIT BREAKER, 4A,2 POLE,SCR TERM
16412	CIRCUIT BREAKER, 5A,2 POLE,.250 TAB
25743	CIRCUIT BREAKER, 6A, 2 POLE, 8-32 SCR
17908	CIRCUIT BREAKER, 12.5A AUX TRP COIL

22931	CIRCUIT BREAKER, 15A,2 POLE,AUX TC
25742	CIRCUIT BREAKER, 20A, 2P, AUX TRP,8-32

Power Supply Components and Assemblies

13782	ASSY, MODIFIED, METAL OXIDE VARISTOR, 130 VRMS
13772	ASSY, MODIFIED, METAL OXIDE VARISTOR, 275 VRMS
17064	ASSY, SOFTSTART
17836	ASSY, SOFTSTART, INT'L
14662	CAP ALUM J 1100UF 450V, CHASSIS ASSY, PPS
16860	CAP ALUM J 2200UF 450V, ASSY, PH2 P.S. TRAY
14594	CAP OIL H 50 UF, AC, PWR FACTOR CORRECTOR
16914	DIODE BRDGE MDA3506 35 A 600V, ASSY, PHASE II P.S. TRAY
16331	FERRITE BEAD 83-10-A637-1000 CABLE ASSY, FOOTSWITCH CABLE ASSY, PRINTER INTERFACE CABLE ASSY, FOOTSWITCH CVS/FLW D CABLE ASSY, HARNESS, SYS PWR, DC, PH2/PH2B
17322	FERRITE BEAD 2643540002 HARNESS, SYS PWR, DC, PH2B
16907	FERRITE BEAD 2677006301, HARNESS, SOFTSTART TO PDB
18729	IC TEMP SENSOR AD592AN, ASSY, REMOTE TEMP SENSOR, FAN PANEL
17461	IND 8MH 4A PF CORR, PH2 P.S. TRAY
19141	IND PWR HV BUS 2 INTL, ASSY, PH2 P.S. TRAY
18728	OPTO DSPLY MAN3910A RED CA, LED DISPLAY BOARD, P.S. TRAY
16910	RELAY, POWER DPST-NO, ASSY, SOFTSTART
16909	RELAY, SOFT-START
16699	RELAY, SOLID STATE GA8-2B02, PCB ASSY PDB II
18504	RESISTOR ASSY, HV BUS DISCHARGE, PDB 2, 250 OHM
17320	RESISTOR ASSY, PPS 2Q OVP RES, 1.5 OHM, 3%
16906	RESISTOR, WW, W A 3.0 RH-50 SOFTSTART
20154	XFMR PWR ISOLN PH2 INT'L 2KVA 50/60 HZ (MAIN XFMR, P.S.TRAY)
16863	XFMR PWR ISOLN PH2 USA 2KVA 60 HZ (MAIN XFMR, P.S.TRAY)

Hardware

19060	ADAPTOR, HV BUS IND. TO PS TRAY
20390	BANANA PLUG W/8-32X5/8 STUD, ASSY, LPS-TRAY
14596	BOOT RUBBER, CAP TERMINALS, ASSY, LPS-TRAY
14755	CLAMP, CAPACITOR 2.5 DIA, CHASSIS ASSY, P.P.S. PHASE II
16908	CLAMP, CAPACITOR 3-IN DIA, ASSY, PHASE II P.S. TRAY
16916	CLAMP, CAPACITOR, ASSY, PHASE II P.S. TRAY
12082	CLAMP, PAINTED CABLE, ASSY, P.S. REAR PNL

21749	COVER, FUSE-INSULATED PUSH-ON, ASSY, PHASE II P.S. TRAY
21168	COVER, HV BUS WARNING IND PCB
18501	COVER, SOFTSTART ASSY
20264	COVER, TERM BLK, 8 POS, CLEAR, ASSY, PHASE II P.S. TRAY
13306	FILTER, CM INPUT, ASSY, LPS R-PNL, PH2B
11255	FILTER, EMI, 10 AMP, ASSY, LPS R-PNL, PH2B
16691	FUSECLIP, PDB, ASSY, SOFTSTART
23069	GROMMET ISOLATOR, #10-1LB RTG, P.S. TRAY
23067	GROMMET ISOLATOR, #10-4LB RTG, P.S. TRAY
23065	GROMMET ISOLATOR, 1/4-20 11LBS, P.S. TRAY
12036	GROMMET, CABLE FEEDTHRU, PANEL ASSY, REAR, PH2 INTL
18499	HEATSINK, FAN DRIVER
20265	JUMPER, TERM BLK, OVER-BARRIER, ASSY, P.S. TRAY
14307	LAMP NEON 80-135V 1.9 MA, PCB ASSY HV BUS WARN INDICATE
25234	PAD, THERMAL CONDUCTOR, 1"X 2", PCB ASSY FAN DRIVER BOARD
22281	PLUG, "SCHUKO"-GERMAN/FRENCH, CABLE ASSY, SYS PWR, INT'L
13309	RECPT, HOSP GRADE DUPLEX, ASSY, P.S. REAR PNL DOMESTIC
13312	RECPT.FEM.POWER IEC PNL.MTG., PANEL ASSY, REAR, INT'L
19905	SHIELD, TERMINAL, SCANNER 5V PS
19405	SPACER, INSUL, SOFTSTART COVER
17275	TERMINAL BLK, 8 POS 9/16 DBL, ASSY, P.S. TRAY

Fuses

10090	FUSE,.063 AMP, SB, PCB ASSY PDB, INT'L
16413	FUSE,.125 AMP, AXIAL LEAD, PCB ASSY XMT
16693	FUSE,.2 AMP,SB, PCB ASSY PDB, DOM
19476	FUSE,.250 AMP SLO BLO, PCB ASSY PPS
12378	FUSE, 2 AMP SLO BLO, PCB ASSY PDB
13199	FUSE, 4 AMP CERAMIC SLO-BLO, PCB ASSY PPS
18336	FUSE, 4 AMP SLO BLO 5x20mm, ASSY, SOFTSTART, INT'L
18122	FUSE, 5 AMP GLASS SLO-BLO, ASSY, SOFTSTART
11259	FUSE, 5 AMP, ASSY SCAN CONVERTER P/S

Printed Circuit Boards

23722	ASSY, GAIN POT
18242	ASSY, HV BUS WARN INDICATE
24352	ASSY, LED DISPLAY BOARD
25242	ASSY, LSB, BKLT
25720	ASSY, LSB2 UPGD,NON-CC
25455	ASSY, LSB2 XP, UPGD CC
24562	ASSY, MCB3 B/W CVS,XP
24082	ASSY, MCB3 COLOR, XP
23692	ASSY, PADDLESWITCH V
25454	ASSY, PSB XP UPGD
16952	ASSY, SCMB II
10362	ASSY, SMB
24572	ASSY, SOFTKEY SW BD 9"
23712	ASSY, SOFTKEY SW. BD. 12"
10332T	ASSY, TSTD APD
19422T	ASSY, TSTD AUD
17332T	ASSY, TSTD AUX
22383T	ASSY, TSTD AUX CW PREAMP
18522T	ASSY, TSTD BBQ 3
17752T	ASSY, TSTD CED NTSC
17652T	ASSY, TSTD CED PAL
19152T	ASSY, TSTD CMB
20662T	ASSY, TSTD CSC 2
22172T	ASSY, TSTD CSI 2
17182T	ASSY, TSTD CVC
18552T	ASSY, TSTD DAQ 2
19312T	ASSY, TSTD DAQ 3
10392T	ASSY, TSTD DBL
22192T	ASSY, TSTD DBR 3
13502T	ASSY, TSTD DCC 2
21552T	ASSY, TSTD DCC 3
13322T	ASSY, TSTD DCP
19562T	ASSY, TSTD DCP 2
14922T	ASSY, TSTD DSP 2
24609T	ASSY, TSTD ECGII FRNT/POTED XP
19522T	ASSY, TSTD FEB 2
19202T	ASSY, TSTD FEC 2
19962T	ASSY, TSTD FEM
20412T	ASSY, TSTD FPC 4

12902T	ASSY, TSTD IC 2
21012T	ASSY, TSTD IGD 2
16442T	ASSY, TSTD MEX
10162T	ASSY, TSTD MMB
17932T	ASSY, TSTD MXK 2
22082T	ASSY, TSTD OC 3
22082TI	ASSY, TSTD OC 3 INT'L
18452T	ASSY, TSTD PDB 2
17912T	ASSY, TSTD RCV 2
14282T	ASSY, TSTD SCM 2
18182T	ASSY, TSTD SCP 3
18132T	ASSY, TSTD SDL 2
18512T	ASSY, TSTD STG 4
16982T	ASSY, TSTD TDI 2/1DL
22642T	ASSY, TSTD TDI 3
10412T	ASSY, TSTD TRM
19982T	ASSY, TSTD VDT 2
16942T	ASSY, TSTD XDY 3
20992T	ASSY, TSTD XMT 4

Switch Assemblies and Switches

17929	ASSY, ROCKER SWITCH, PH2, USA
17942	ASSY, ROCKER SWITCH, PH2, INT'L
18125	SWITCH, MINI PUSHBUTTON, PCB ASSY SOFTKEY SW. BD
21265	SWITCH, PUSHBUTTON, LIGHTED, PCB ASSY SW BD
17925	SWITCH, ROCKER ILL 16A 120VAC, PS, USA
17924	SWITCH, ROCKER ILL 16A 250VAC, PS, INTERNATIONAL
24462	SWITCH, SPDT MOM CUSTOM, LIGHTED SWITCH BOARD
16915	SWITCH, THRMAL 160'F COR, ASSY, SOFTSTART

Transducers

Accessories

19580	BAG, SANITARY STORAGE TV/TR
20939	BOX, SHIPPING,INTERCAVITY XDCR
16718	CASE, NEEDLE GUIDE ADAPTERS
12026	CASE, TRANSDUCER SHIPPING

18968	DISPOSABLE, SINGLE NG KIT STRL
19407	DISPOSABLE, STERILE N/G 30/BOX
15553	DL HANDLE SPLIT HOUSING
15551	DL HOUSING LT SIDE
15552	DL HOUSING RT SIDE
21990	FORM, BIOPSY N/G, REORDER
20941	KIT, DISINFECTION/RETURN EV/ER
18895	KIT, NEEDLE GUIDE VERIFICATION
20940	LABEL SEAL INTERCAVITY XDCR
15176	STRAIN RELIEF D/L CONN 128 CH

Assemblies

15023	TRANSDUCER, PACKED, S228
15576	TRANSDUCER, PACKED, V328
24127	TRANSDUCER, PACKED, C544
15400	TRANSDUCER, PACKED, S519
23100	TRANSDUCER, PACKED, S2194
15838	TRANSDUCER, PACKED, S3194
15950	TRANSDUCER, PACKED, S5192
19515	TRANSDUCER, PACKED, S7146
15570	TRANSDUCER, PACKED, L382
15560	TRANSDUCER, PACKED, L312
15658	TRANSDUCER, PACKED, L538
15558	TRANSDUCER, PACKED, L558
15738	TRANSDUCER, PACKED, L7384
19512	TRANSDUCER, PACKED, I7505
19513	TRANSDUCER, PACKED, I7146
22706	TRANSDUCER, PACKED, I7145
17869	TRANSDUCER, PACKED, EV519
15920	TRANSDUCER, PACKED, AUX CW, 2.0 MHZ
15946	TRANSDUCER, PACKED, I5100

User Controls

Keyboards And Keycaps

128 Systems field-upgraded to 128/5 or 128/10:

25480	ASSY, CHERRY KEYBOARD, with white CVS keycaps installed
25479	ASSY, CHERRY KEYBOARD, with white Radiology keycaps installed
25451	KEYCAP SET, CHERRY, WHITE, CVS
25478	KEYCAP SET, CHERRY, WHITE, RADIOLOGY

XP Systems manufactured with keyboards made by Cherry:

25594	ASSY, CHERRY KEYBOARD, with gray CVS keycaps installed
25595	ASSY, CHERRY KEYBOARD, with gray Radiology keycaps installed
25591	KEYCAP SET, CHERRY, GRAY, CVS
25592	KEYCAP SET, CHERRY, GRAY, RADIOLOGY

XP Systems manufactured with keyboards made by Oak:

24645	KEYBOARD, OAK, CAPLESS
24066	KEYBOARD, OAK FTM, CD XP
24065	KEYBOARD, OAK FTM, CVS XP
24064	KEYBOARD, OAK FTM, RD, XP
24794	KEYCAP SET, OAK, GRAY, CVS
24796	KEYCAP SET, OAK, GRAY, RADIOLOGY

Knobs

16529	KNOB, 1/4 SHAFT, .320 HT.
16530	KNOB, 1/8 SHAFT, .550 HT.
23553	KNOB, CONCENTRIC RING, XP
23552	KNOB, INDICATOR, XP
25623	KNOB, INDICATOR, SINGLE, GRAY

Lens Caps

23555	ADAPTER, CURVED LENS CAP, 90 A
25452	KIT, LENS CAPS XP UPGRADE
24533	LENS CAP XP PRINTED CAL SIZE

24515	LENS CAP XP,PRINTED AUX CW
24532	LENS CAP XP,PRINTED CAL POS
24516	LENS CAP XP,PRINTED CINE
24530	LENS CAP XP,PRINTED CURSOR
24519	LENS CAP XP,PRINTED D COLOR
24517	LENS CAP XP,PRINTED D CW
24520	LENS CAP XP,PRINTED D PW
24522	LENS CAP XP,PRINTED FREEZE
24527	LENS CAP XP,PRINTED LF XDCR
24518	LENS CAP XP,PRINTED M MODE
25253	LENS CAP XP,PRINTED MULTI HZ
24524	LENS CAP XP,PRINTED PLAYBACK
24523	LENS CAP XP,PRINTED PRINT
24528	LENS CAP XP,PRINTED RES
24525	LENS CAP XP,PRINTED TAPE
24531	LENS CAP XP,PRINTED TRACE
24521	LENS CAP XP,PRINTED UPDATE
25450	LENS CAP, XP UPG BZL L/R INVR
23554	LENS CAP, CURVED, XP
25356	LENS CAP, LIGHTED, RETROFIT
25462	LENS CAP, PRNTD UPG, AUX CW
25464	LENS CAP, PRNTD UPG, CAL POS
25463	LENS CAP, PRNTD UPG, CAL SIZE
25461	LENS CAP, PRNTD UPG, CINE
25466	LENS CAP, PRNTD UPG, CURSOR
25458	LENS CAP, PRNTD UPG, D COLOR
25460	LENS CAP, PRNTD UPG, D CW
25457	LENS CAP, PRNTD UPG, D PW
25473	LENS CAP, PRNTD UPG, FREEZE
25468	LENS CAP, PRNTD UPG, LF XDCR
25459	LENS CAP, PRNTD UPG, M-MODE
25469	LENS CAP, PRNTD UPG, MULTI Hz
25471	LENS CAP, PRNTD UPG, PLAYBACK
25472	LENS CAP, PRNTD UPG, PRINT
25467	LENS CAP, PRNTD UPG, RES
25470	LENS CAP, PRNTD UPG, TAPE
25465	LENS CAP, PRNTD UPG, TRACE
25456	LENS CAP, PRNTD UPG, UPDATE
10933	LENS CAP, SWITCH
18015	SWITCH CAP, .450 SQUARE WHITE

Trackball

16964	TRACKBALL, BLACK
24008	TRACKBALL, GREY, XP

SECTION 9

Engineering Drawings

Scope

The drawings contained in this section illustrate the following major assemblies of the Acuson 128XP system:

- Acuson 128XP final assembly
- Upper cart (chassis, board cage, monitor, keyboard)
- Lower cart (chassis, board cage, power supplies)
- Power supplies (lower cart, trays)
- Power distribution diagrams

Adjacent to each drawing is a bill of materials for the assembly shown in the drawing. To facilitate part replacement, the bill of materials is cross referenced to the drawing. The circled number on the drawing corresponds to the Item No. on the bill of materials.

The drawings are arranged in two sets. The first set contains drawings applying to both domestic and international units (Acuson 128XP system, upper and lower carts); the second set (power supplies) has the domestic and international drawings grouped as separate units.

Refer to the appropriate earlier service manual for engineering drawings pertaining to Acuson 128/10 and Acuson 128/5 systems, whose mainframes and power supplies differ from the 128XP/10, 128XP/5, and 128XP/E systems.

BILL OF MATERIAL

AS OF 12/06/90

24935 **UPPER CART ASSEMBLY, 128XP**

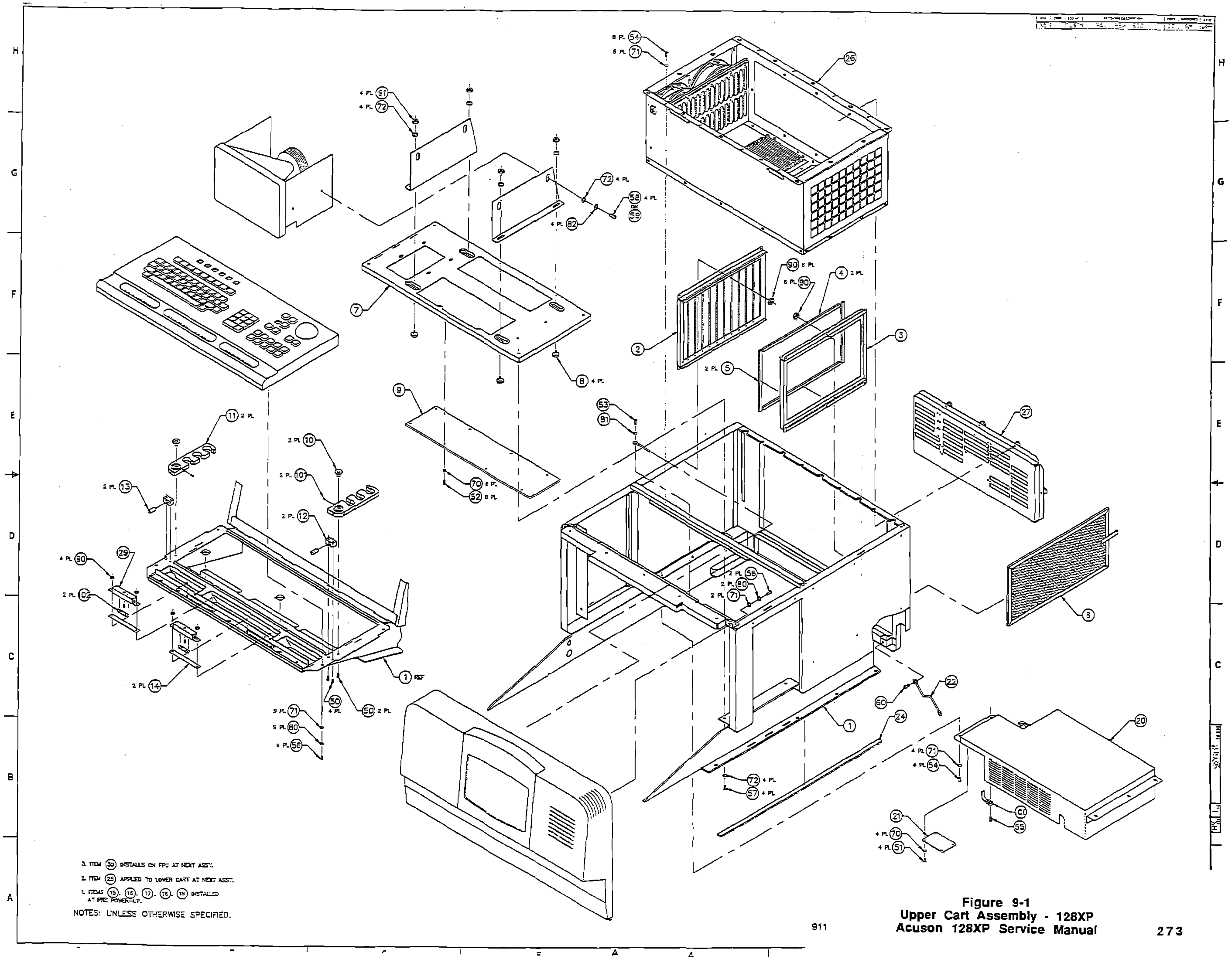
PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
23627	WELD'T, UPPR CART, 128XP	XE	1	1.000
23736	PLENUM ASSY, LF, UC, 128XP	XB	2	1.000
23737	PLENUM ASSY, RT, UC, 128XP	XB	3	1.000
22252	FOAM POLY UC PLENUM,12.6L	XB	4	2.000
22495	FOAM POLY UC PLENUM, 7.9L	XB	5	2.000
23849	FILTER, PLENUM, RT, UC, 128XP	XA	6	1.000
19326	SUPPORT, MONITOR BASE II	B	7	1.000
19327	FASTENER, MONITOR SUPPORT	B	8	4.000
19422T	ASSY, TSTD AUDIO PROCESSOR II	A	9	1.000
23759	RETAINER, XDCR FLIP-OUT, XP	A	10	2.000
23760	FLIP-OUT, XDCR, XP	A	11	2.000
23762	PLUNGER BLOCK, XDCR FLP-OUT,XP	A	12	2.000
17954	PLUNGER, SPRING	A	13	2.000
17899	DIFFUSER, DASH HANDLE (FLOW)	A	14	2.000
18035	CABLE ASSY, S.C.-FPC II FLOW	A	15	1.000
18036	CABLE ASSY, INTRCHAS J5 FLOW	B	16	1.000
18037	CABLE ASSY, INTRCHAS J4 FLOW	B	17	1.000
18038	CABLE ASSY, INTRCHAS J6 FLOW	B	18	1.000
18039	CABLE ASSY, INTRCHAS J20 FLOW	A	19	1.000
16894	ASSY, UPPER CART P.S. PHASE II	J	20	1.000
18782T	ASSY, TSTD FDB	A	21	1.000
10785	CABLE, SAFETY-CART	D	22	1.000
19576	SHIELDING, UC CVR, FRONT/REAR	A	23	1.000
22260	SHIELDING, UC TO LC, RT SIDE	XA	24	1.000
22614	SHIELDING STRIP, F/R, UC TO LC	A	25	2.000
24936	ASSY, SCAN CONVERTER, 128XP	XB	26	1.000
17077	COVER, I/O CONN PCB (SCC) FLOW	B	27	1.000
14851	CABLE ASSY, FPCII TO PADDLEBD	A	28	1.000
18223	HARNESS, HANDLE LAMPS (FLOW)	D	29	1.000
21231	CABLE ASSY, PROBE TEMP INTCI	B	30	1.000
12078	SCR,6-32x.25 PH FLAT 110deg ZN	1	50	6.000
18565	SCR, 6-32x1/2 PH PN NYPATCH ZN	A	51	4.000
21237	SCR, 6-32x7/8 PH PN ZN	A	52	8.000
11490	SCR, 8-32X.25 PH PN STD ZN	A	53	1.000
12677	SCR, 8-32X3/8 PH PN NYPATCH ZN	A	54	12.000
12678	SCR, 8-32X1/2 PH PN NYPATCH ZN	A	55	1.000
12102	SCR, 8-32X1/2 PH PN STD ZN	1	56	11.000
12682	SCR,10-32X3/8 PH PN NYPATCH ZN	A	57	4.000

BILL OF MATERIAL

AS OF 12/06/90

24935 **UPPER CART ASSEMBLY, 128XP (Cont.)**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
11873	SCR, 10-32X1/2 PH PN STD ZN	A	58	4.000
20181	SCR, M5x12 PH PN ZN	A	59	4.000
11708	SCREW,1/4-20 ALLEN SHOULDER SS	A	60	1.000
12143	WSHR, #6 FLAT ZN	A	70	12.000
12099	WSHR, #8 FLAT ZN	1	71	23.000
11871	WSHR, #10 FLAT ZN SAE	A	72	12.000
11944	WASHER, #8 SPLIT LOCK, ZNC	A	80	11.000
13633	WSHR, #8 INT'L TOOTH ZN	1	81	1.000
11943	WASHER,#10 SPLIT LOCK, ZINC	A	82	4.000
11866	KEPNUT, 6-32 STEEL ZNC	A	90	16.000
11865	NUT, 10-32 KEP ZN	A	91	4.000
17084	CLAMP TIE, #10	A	100	1.000
25020	SET SCREW, 6-32x3/16" S/S CUP	A	101	2.000
25208	LAMP, FUUSE, 6V/.1A	XA	102	2.000
17237	FOAM, KYBD PROTECTOR	A	103	1.000



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ITEMS (15), (16), (17), (18), (19) INSTALLED AT PRE POWER-UP.
2. ITEM (25) APPLIED TO LOWER CART AT NEXT ASSY.
3. ITEM (30) INSTALLS ON FPC AT NEXT ASSY.

911

Figure 9-1
Upper Cart Assembly - 128XP

Bill of Materials
and
Engineering Drawing:

Scan Converter Assembly

See Next Page

BILL OF MATERIAL

AS OF 12/06/90

24936 SCAN CONVERTER ASSEMBLY, 128XP

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
22280	ASSY, SCC, PH2B	XC	1	1.000
16952	PCB ASSY SCMB II	A	2	1.000
16970	BRACKET,MOTHERBD STIFNR (FLOW)	B	3	1.000
22486	ASSY, FAN PNL, PH2B	XE	4	1.000
16969	COVER, BOTTOM S.C.C. (FLOW)	C	5	1.000
18565	SCR, 6-32x1/2 PH PN NYPATCH ZN	A	7	20.000
12143	WSHR, #6 FLAT ZN	A	8	22.000
13785	WSHR, LOCK, #6 INT'L TOOTH	1	9	26.000
13773	SCR, 6-32X1/4 PH PN NYP	1	10	28.000

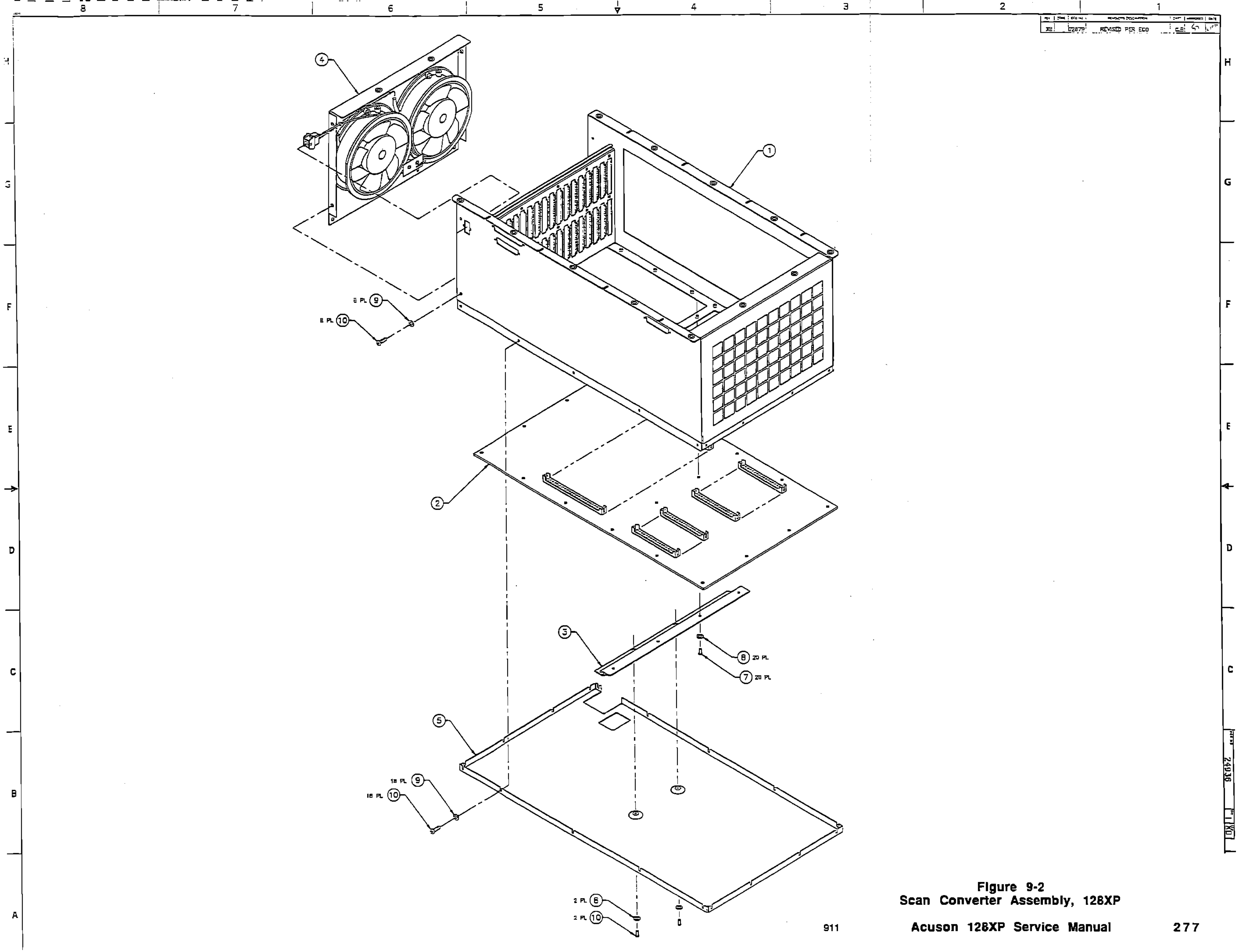


Figure 9-2
Scan Converter Assembly, 128XP

Bill of Materials
and
Engineering Drawing:

10" Monitor Bezel Assembly, 128XP

See Next Page

BILL OF MATERIAL

AS OF 12/06/90

24934 **10" MONITOR BEZEL ASSEMBLY, 128XP**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
25059	BEZEL, MON, W/10"CLR INSERT,XP	A	1	1.000
23541	DOOR, VIDEO, XP	A	3	1.000
23669	BLOCK, PIVOT, VIDEO DOOR,128XP	XA	4	2.000
23671	BRACKET, VIDEO DOOR, 128XP	XA	5	1.000
23921	DIFFUSER, LAMP, MON BZL,XP	A	7	1.000
23556	CAP, DGC SLIDE POT, 128XP	XA	9	8.000
19629	BAFFLE, SPEAKER	C	11	2.000
25540	FOAM PAD, SPEAKER HOUSING	XA	12	1.000
24346	ASSY, SPEAKER, 128XP	XA	20	2.000
11118	CABLE ASSY, GAIN CONTROL PANEL	E	21	1.000
24159	HARNESS,MON CNTRL PWR, XP	A	23	1.000
24158	HARNESS, HEADPHONE, 128XP	A	24	1.000
25009	HARNESS, MICROPHONE, 128XP	XA	25	1.000
23702	PCB ASSY DGC III	XD	30	1.000
24472	PCB ASSY, DLB	XC	31	1.000
24572	PCB ASSY, SOFTKEY SW BD 9"	A	32	1.000
25506	SCR, 6-32X1 PH PN NYPATCH ZN	A	40	2.000
13773	SCR, 6-32X1/4 PH PN NYP	1	41	7.000
14382	SCR,6X32X.750 PH STD ZN	A	42	2.000
25507	SCR, 6-32X3/8, BUTTON, SKT, SS	A	43	2.000
19136	SCR, 6-32x3/16, BUTTON,SKT,STL	A	44	2.000
12143	WSHR, #6 FLAT ZN	A	47	8.000
12099	WSHR, #8 FLAT ZN	1	49	4.000
12109	WSHR, #8FLAT NYLON	A	50	4.000
25413	KIT, GROUNDING, BEZEL 128XP	XB	52	1.000

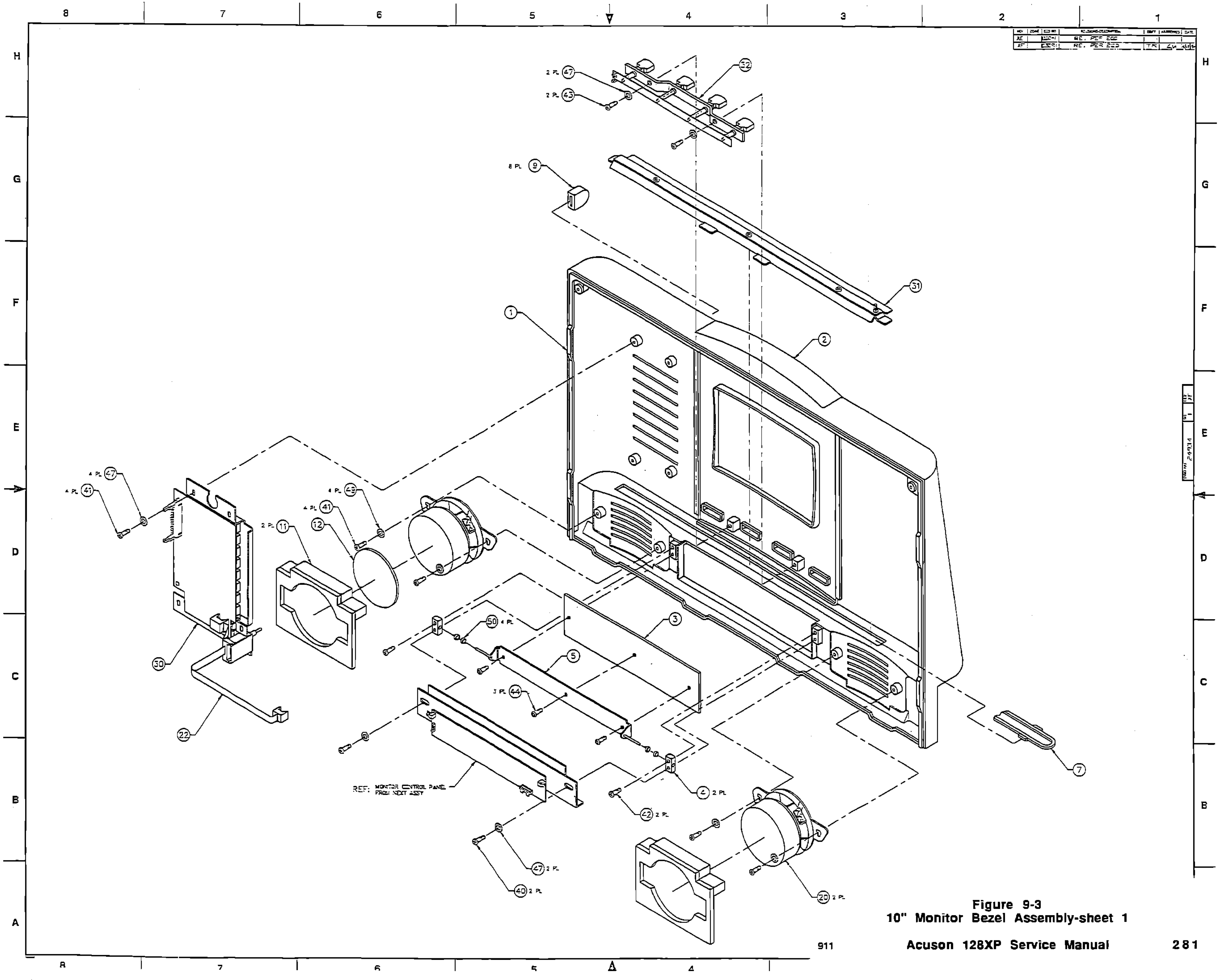


Figure 9-3
10" Monitor Bezel Assembly-sheet 1

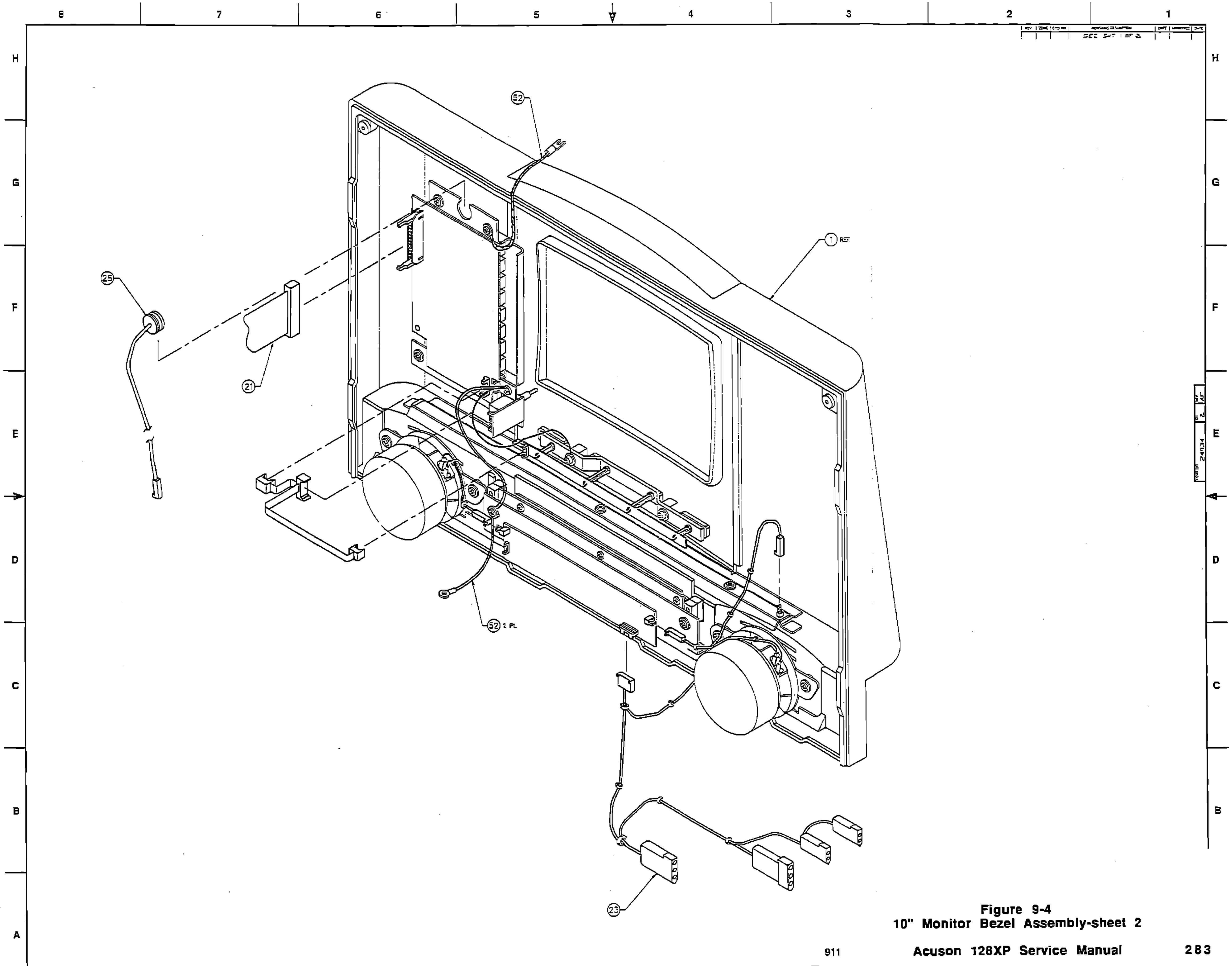


Figure 9-4
10" Monitor Bezel Assembly-sheet 2

Bill of Materials
and
Engineering Drawing:

12" Monitor Bezel Assembly, 128XP

See Next Page

BILL OF MATERIAL

AS OF 12/06/90

24933 12" MONITOR BEZEL ASSEMBLY, 128XP

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
25060	BEZEL, MON, W/12"CLR INSERT,XP	A	1	1.000
23541	DOOR, VIDEO, XP	A	3	1.000
23669	BLOCK, PIVOT, VIDEO DOOR,128XP	XA	4	2.000
23671	BRACKET, VIDEO DOOR, 128XP	XA	5	1.000
23921	DIFFUSER, LAMP, MON BZL,XP	A	7	1.000
23556	CAP, DGC SLIDE POT, 128XP	XA	9	8.000
19629	BAFFLE, SPEAKER	C	11	2.000
25540	FOAM PAD, SPEAKER HOUSING	XA	12	1.000
24346	ASSY, SPEAKER, 128XP	XA	20	2.000
11118	CABLE ASSY, GAIN CONTROL PANEL	E	21	1.000
24159	HARNESS,MON CNTRL PWR, XP	A	23	1.000
24158	HARNESS, HEADPHONE, 128XP	A	24	1.000
25009	HARNESS, MICROPHONE, 128XP	XA	25	1.000
23702	PCB ASSY DGC III	XD	30	1.000
24472	PCB ASSY, DLB	XC	31	1.000
23712	PCB ASSY SOFTKEY SW. BD. 12"	A	32	1.000
25506	SCR, 6-32X1 PH PN NYPATCH ZN	A	40	2.000
13773	SCR, 6-32X1/4 PH PN NYP	1	41	8.000
14382	SCR,6X32X.750 PH STD ZN	A	42	2.000
25507	SCR, 6-32X3/8, BUTTON, SKT, SS	A	43	2.000
19136	SCR, 6-32x3/16, BUTTON,SKT,STL	A	44	2.000
12143	WSHR, #6 FLAT ZN	A	47	8.000
12099	WSHR, #8 FLAT ZN	1	49	4.000
12109	WSHR, #8FLAT NYLON	A	50	4.000
25413	KIT, GROUNDING, BEZEL 128XP	XB	52	1.000

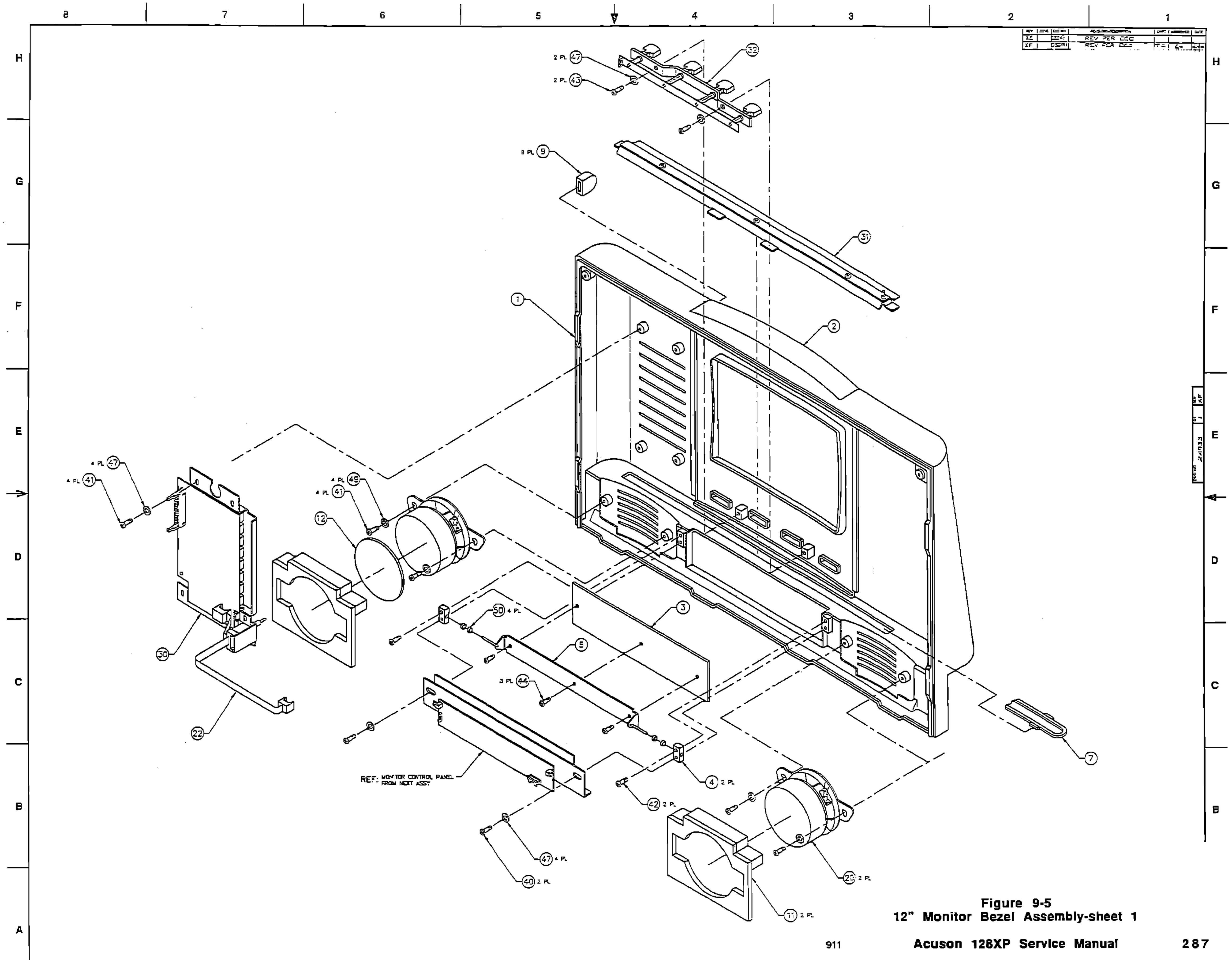


Figure 9-5
12" Monitor Bezel Assembly-sheet 1

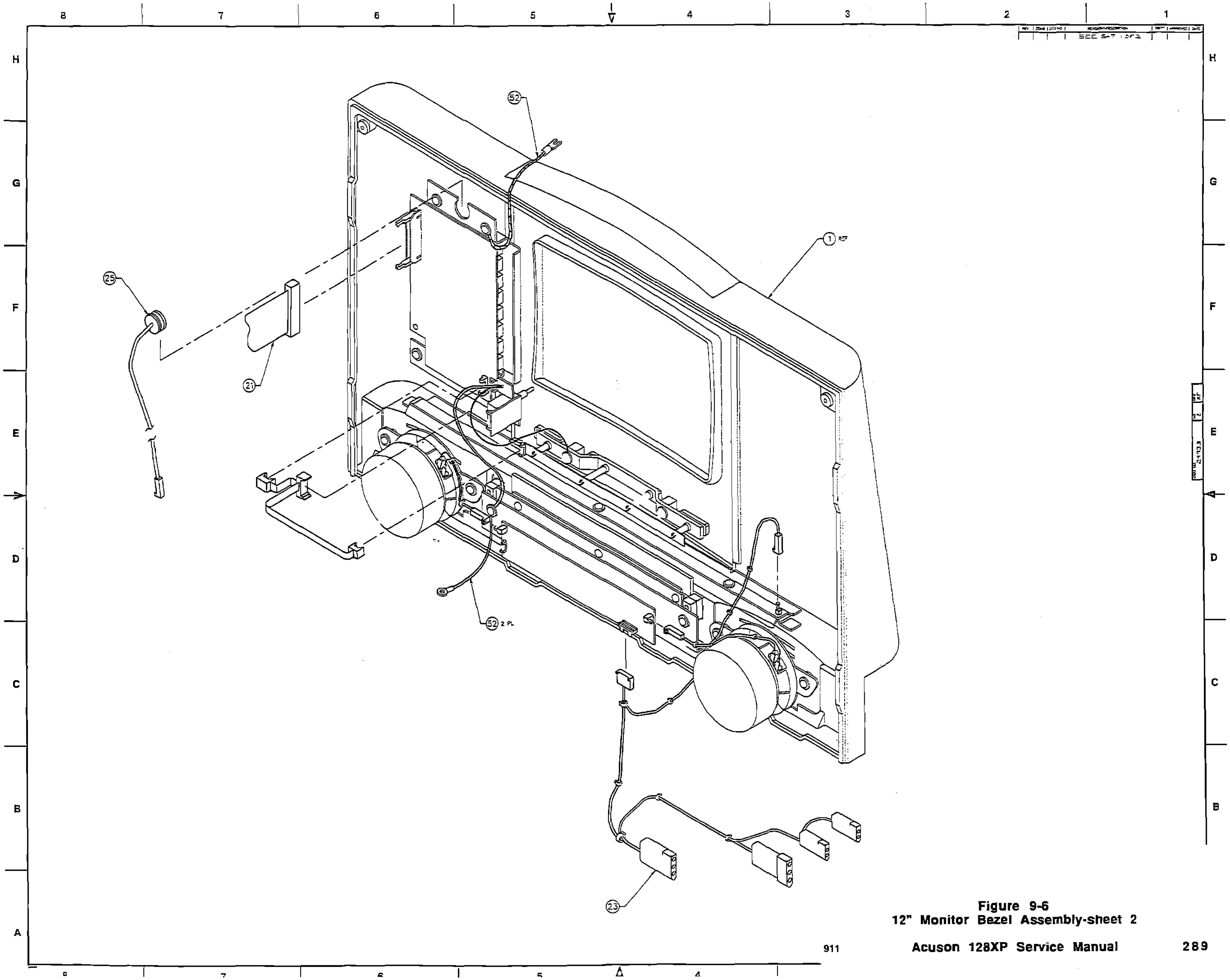


Figure 9-6
12" Monitor Bezel Assembly-sheet 2

Bill of Materials
and
Engineering Drawing:

Keyboard and Trim Assembly, CDI

See Next Page

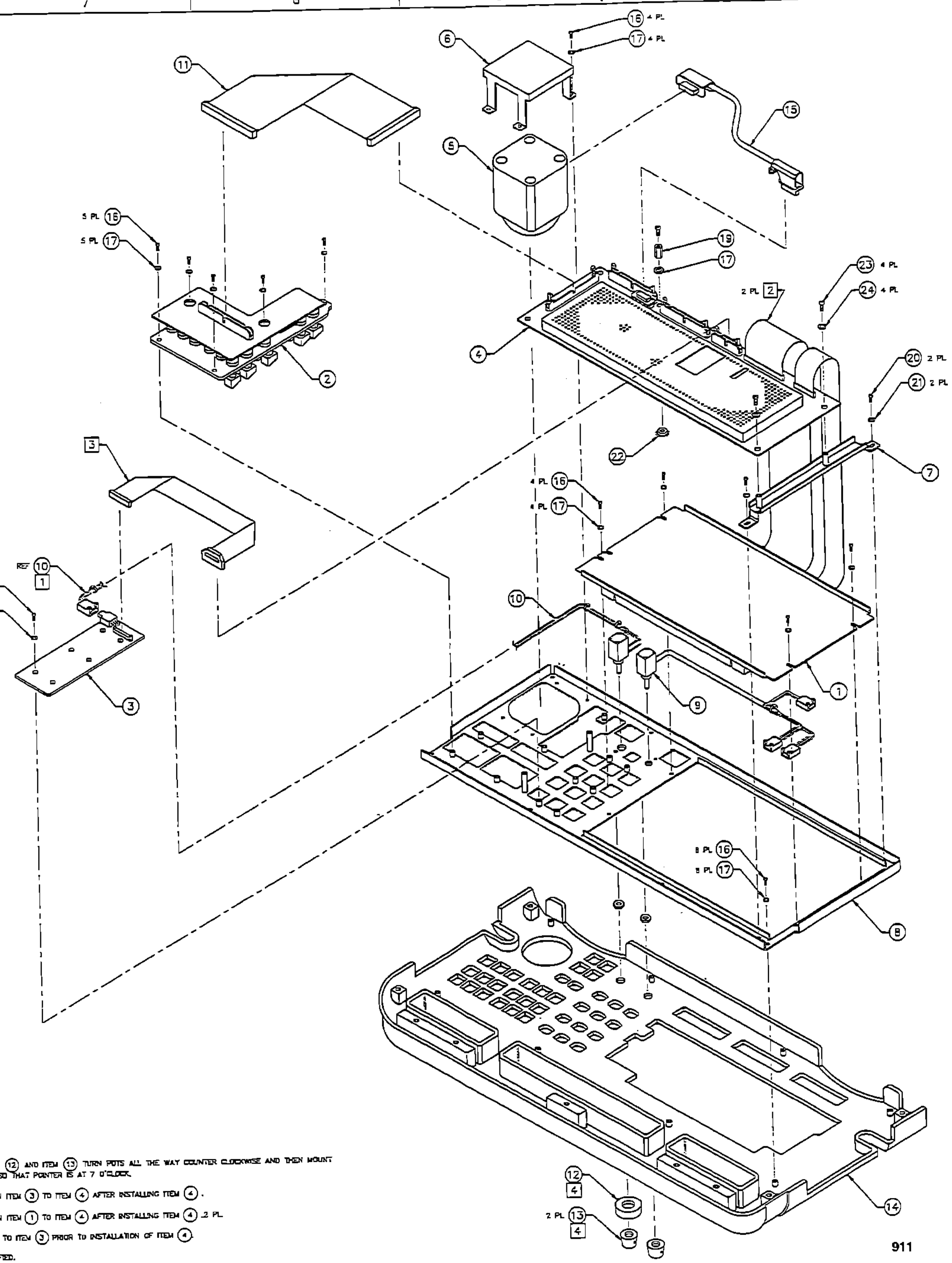
BILL OF MATERIAL

AS OF 12/06/90

24207 KEYBOARD TRIM ASSEMBLY, CDI, 128XP

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
24066	KEYBOARD, OAK FTM, CD 128XP	A	1	1.000
25242	PCB ASSY, LSB, BKLT	B	2	1.000
23692	PCB ASSY PADDLESWITCH V	XA	3	1.000
20412T	ASSY, TSTED FPC IV	D	4	1.000
24008	TRACKBALL GREY 128XP	XA	5	1.000
23752	HOUSING, TRACKBALL, 128XP	XA	6	1.000
23753	BRACKET, FPC MOUNTING, 128XP	XA	7	1.000
24469	CHASSIS, KYBD BZL, BACKLITE	A	8	1.000
25350	HARNESS, AUDIO VOL POT, BKLT	XA	9	1.000
25349	HARNESS, DOP/CD LEVEL POT, BLKT	XA	10	1.000
24156	CABLE ASSY, FPC TO CSB	XA	11	1.000
23553	KNOB, CONCENTRIC RING, 128XP	XA	12	1.000
23552	KNOB, INDICATOR, 128XP	A	13	2.000
23667	BEZEL, KYBD, COLOR, XP	A	14	1.000
16801	ASSY, TRACKBALL WIRE HARNESS	A	15	1.000
13773	SCR, 6-32X1/4 PH PN NYP	1	16	21.000
12143	WSHR, #6 FLAT ZN	A	17	28.000
11864	SCR, 6-32X1/2 PH PN STD ZN	A	18	6.000
13294	STNDF, 1/4 HEX M-F 6-32X1/4 ZN	A	19	1.000
12284	SCR, 4-40X1/4 PH PN STD ZN	A	20	2.000
12070	WSHR, #4 FLAT ZN	A	21	2.000
11866	KEPNUT, 6-32 STEEL ZNC	A	22	1.000
12676	SCR, 8-32X1/4 PH PN NYPATCH ZN	A	23	4.000
12099	WSHR, #8 FLAT ZN	1	24	4.000

XA	02980	PILOT RELEASE	C.B.		
XB	02994	BOM CHANGE ONLY	C.B.	[illegible]	[illegible]
XC	[illegible]	BOM CHG ONLY	[illegible]	[illegible]	[illegible]



4 PRIOR TO INSTALLING ITEM 12 AND ITEM 13 TURN POTS ALL THE WAY COUNTER CLOCKWISE AND THEN MOUNT ITEM 12 AND ITEM 13 SO THAT POINTER IS AT 7 O'CLOCK.

3 CONNECT RIBBON CABLE ON ITEM 3 TO ITEM 4 AFTER INSTALLING ITEM 4 .

2 CONNECT RIBBON CABLE ON ITEM 1 TO ITEM 4 AFTER INSTALLING ITEM 4 .2 PL.

1 CONNECT CABLE ITEM 10 TO ITEM 3 PRIOR TO INSTALLATION OF ITEM 4.

NOTES: UNLESS OTHERWISE SPECIFIED.

911

Figure 9-7
Keyboard and Trim Assembly, CDI

Bill of Materials
and
Engineering Drawing:

Keyboard and Trim Assembly, CVS

See Next Page

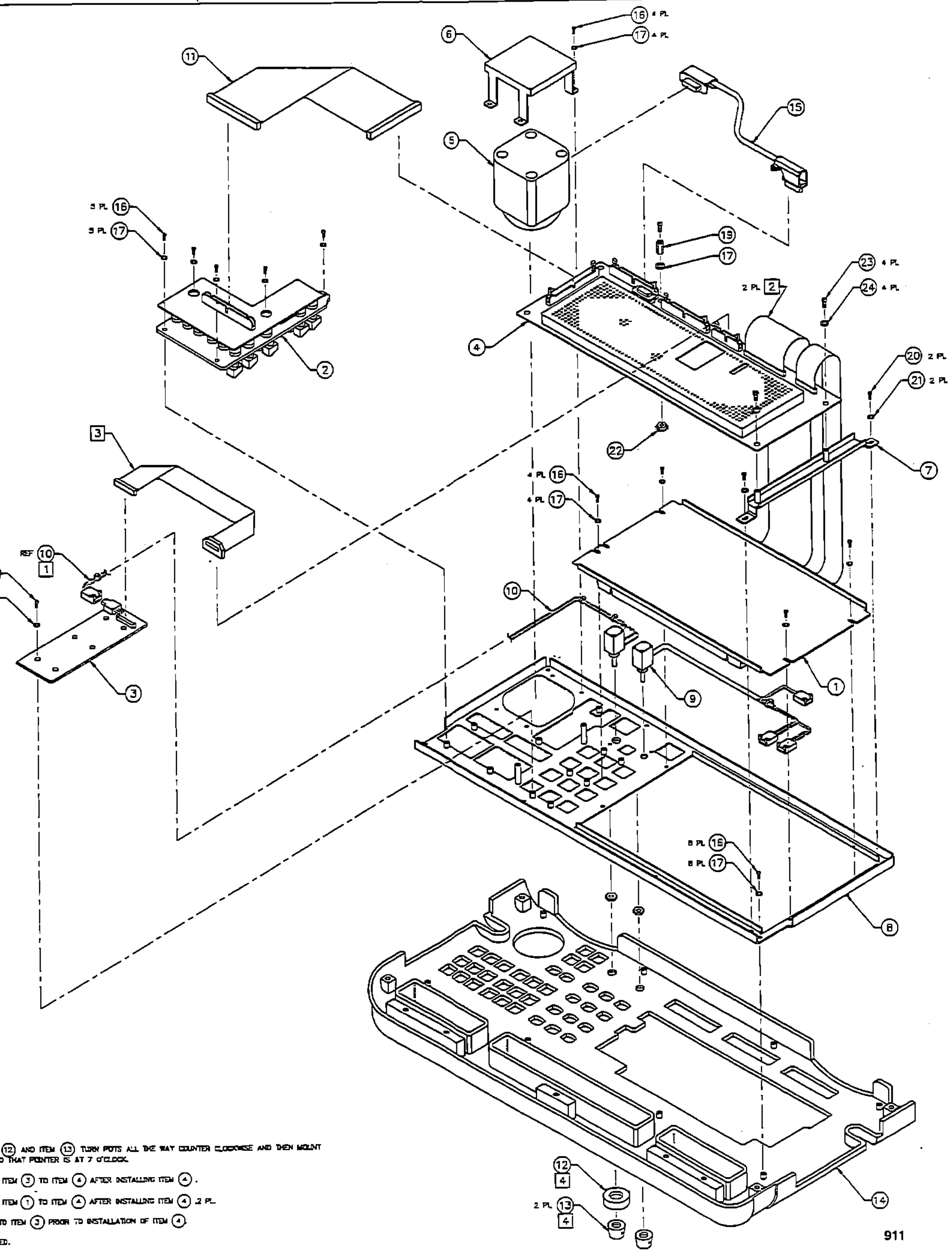
BILL OF MATERIAL

AS OF 12/06/90

24209 **KEYBOARD AND TRIM ASSEMBLY, CVS, 128XP**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
24065	KEYBOARD, OAK FTM, CVS 128XP	A	1	1.000
25242	PCB ASSY, LSB, BKLT	B	2	1.000
23692	PCB ASSY PADDLESWITCH V	XA	3	1.000
20412T	ASSY, TSTED FPC IV	D	4	1.000
24008	TRACKBALL GREY 128XP	XA	5	1.000
23752	HOUSING, TRACKBALL, 128XP	XA	6	1.000
23753	BRACKET, FPC MOUNTING, 128XP	XA	7	1.000
24469	CHASSIS, KYBD BZL, BACKLITE	A	8	1.000
25350	HARNESS, AUDIO VOL POT, BKLT	XA	9	1.000
25349	HARNESS, DOP/CD LEVEL POT, BLKT	XA	10	1.000
24156	CABLE ASSY, FPC TO CSB	XA	11	1.000
23552	KNOB, INDICATOR, 128XP	A	13	2.000
23667	BEZEL, KYBD, COLOR, XP	A	14	1.000
16801	ASSY, TRACKBALL WIRE HARNESS	A	15	1.000
13773	SCR, 6-32X1/4 PH PN NYP	1	16	21.000
12143	WSHR, #6 FLAT ZN	A	17	28.000
11864	SCR, 6-32X1/2 PH PN STD ZN	A	18	6.000
13294	STNDF, 1/4 HEX M-F 6-32X1/4 ZN	A	19	1.000
12284	SCR, 4-40X1/4 PH PN STD ZN	A	20	2.000
12070	WSHR, #4 FLAT ZN	A	21	2.000
11866	KEPNUT, 6-32 STEEL ZNC	A	22	1.000
12676	SCR, 8-32X1/4 PH PN NYPATCH ZN	A	23	4.000
12099	WSHR, #8 FLAT ZN	1	24	4.000

XA		02880	PILOT RELEASE	C.B.		
XB		02994	BOM CHANGE ONLY	C.B.		
XC		03106	BOM CHG ONLY	T.R.		



4 PRIOR TO INSTALLING ITEM 12 AND ITEM 13 TURN POTS ALL THE WAY COUNTER CLOCKWISE AND THEN MOUNT ITEM 12 AND ITEM 13 SO THAT POINTER IS AT 7 O'CLOCK.

3 CONNECT RIBBON CABLE ON ITEM 3 TO ITEM 4 AFTER INSTALLING ITEM 4.

2 CONNECT RIBBON CABLE ON ITEM 1 TO ITEM 4 AFTER INSTALLING ITEM 4 .2 PL.

1 CONNECT CABLE ITEM 10 TO ITEM 3 PRIOR TO INSTALLATION OF ITEM 4.

NOTES: UNLESS OTHERWISE SPECIFIED.

911

Figure 9-8
Keyboard and Trim Assembly, CVS

Bill of Materials
and
Engineering Drawing:

Lighted Switch Board Assembly

See Next Page

BILL OF MATERIAL

AS OF 12/06/90

23682 LIGHTED SWITCH BOARD ASSEMBLY

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
23680	SCH LIGHTED SWITCH BOARD	A	0	.000
23681	PCB LIGHTED SWITCH BOARD	A	1	1.000
21265	SWITCH, PUSHBUTTON, LIGHTED	A	2	22.000
14402	SWITCH, RCKR, SPDT, NO LEVER	1	3	2.000
24312	SCR, 2-56 X 3/16 PH PN STD ZN	A	5	4.000
12075	WSHR, #2 FLAT ZN	1	6	4.000
24313	STNDF, SS Z-56 X 3/8 HEX	A	7	4.000
23557	LEVER, CURVED, PADDLE SWITCH	A	8	2.000
21264	LAMP, INCANDSCNT, T1 18V, .5W	A	10	22.000
23751	PLATE, MOUNTING, LSB, 128XP	XA	11	1.000
23554	LENS CAP, CURVED, 128XP	A	12	4.000
23555	ADAPTER, CURVED LENS CAP,128XP	A	13	22.000
23758	NUT, MOUNTING EAO PUSHBUTTON	A	14	4.000
25022	HDR, 50 POS. NO LATCH	A	16	1.000
24521	LENS CAP 128XP,PRINTED UPDATE	XA	17	1.000
24520	LENS CAP 128XP,PRINTED D PW	XA	18	1.000
24519	LENS CAP 128XP,PRINTED D COLOR	XA	19	1.000
24518	LENS CAP 128XP,PRINTED M MODE	XA	20	1.000
24517	LENS CAP 128XP,PRINTED D CW	XA	21	1.000
24516	LENS CAP 128XP,PRINTED CINE	XA	22	1.000
24522	LENS CAP 128XP,PRINTED FREEZE	XA	23	1.000
24523	LENS CAP 128XP,PRINTED PRINT	XA	24	1.000
24524	LENS CAP 128XP,PRINTED PLAYBACK	XA	25	1.000
24525	LENS CAP 128XP,PRINTED TAPE	XA	26	1.000
25253	LENS CAP 128XP,PRINTED MULTIHZ	XA	27	1.000
24527	LENS CAP 128XP,PRINTED LF XDCR	XA	28	1.000
24528	LENS CAP 128XP,PRINTED RES	XA	29	1.000
24515	LENS CAP 128XP,PRINTED AUX CW	XA	30	1.000
24530	LENS CAP 128XP,PRINTED CURSOR	XA	31	1.000
24531	LENS CAP 128XP,PRINTED TRACE	XA	32	1.000
24532	LENS CAP 128XP,PRINTED CAL POS	XA	33	1.000
24533	LENS CAP 128XP PRINTED CALSIZE	XA	34	1.000

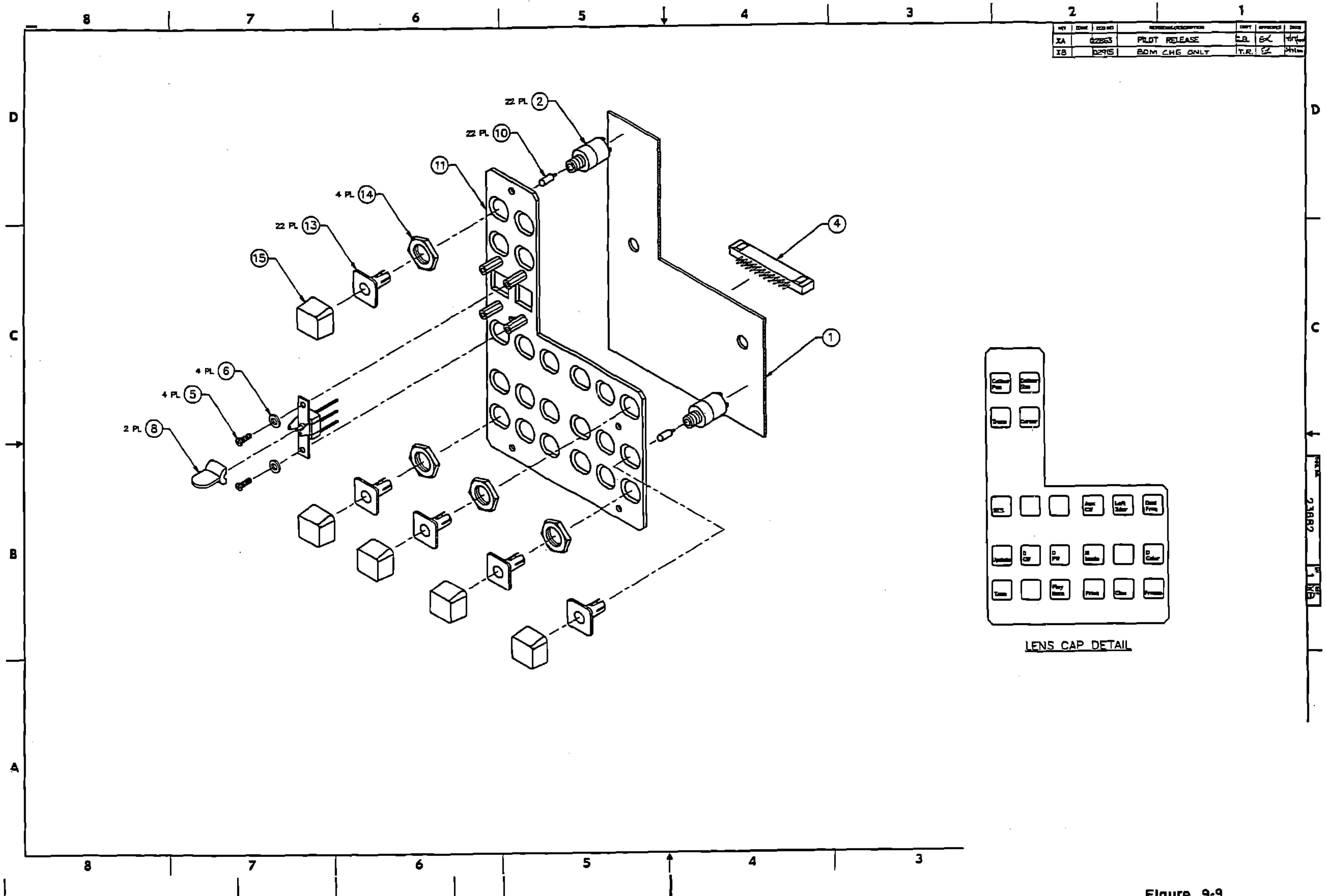


Figure 9-9
Lighted Switch Board Assembly

Bill of Materials
and
Engineering Drawing:

Soft Key Switch Board Assembly

See Next Page

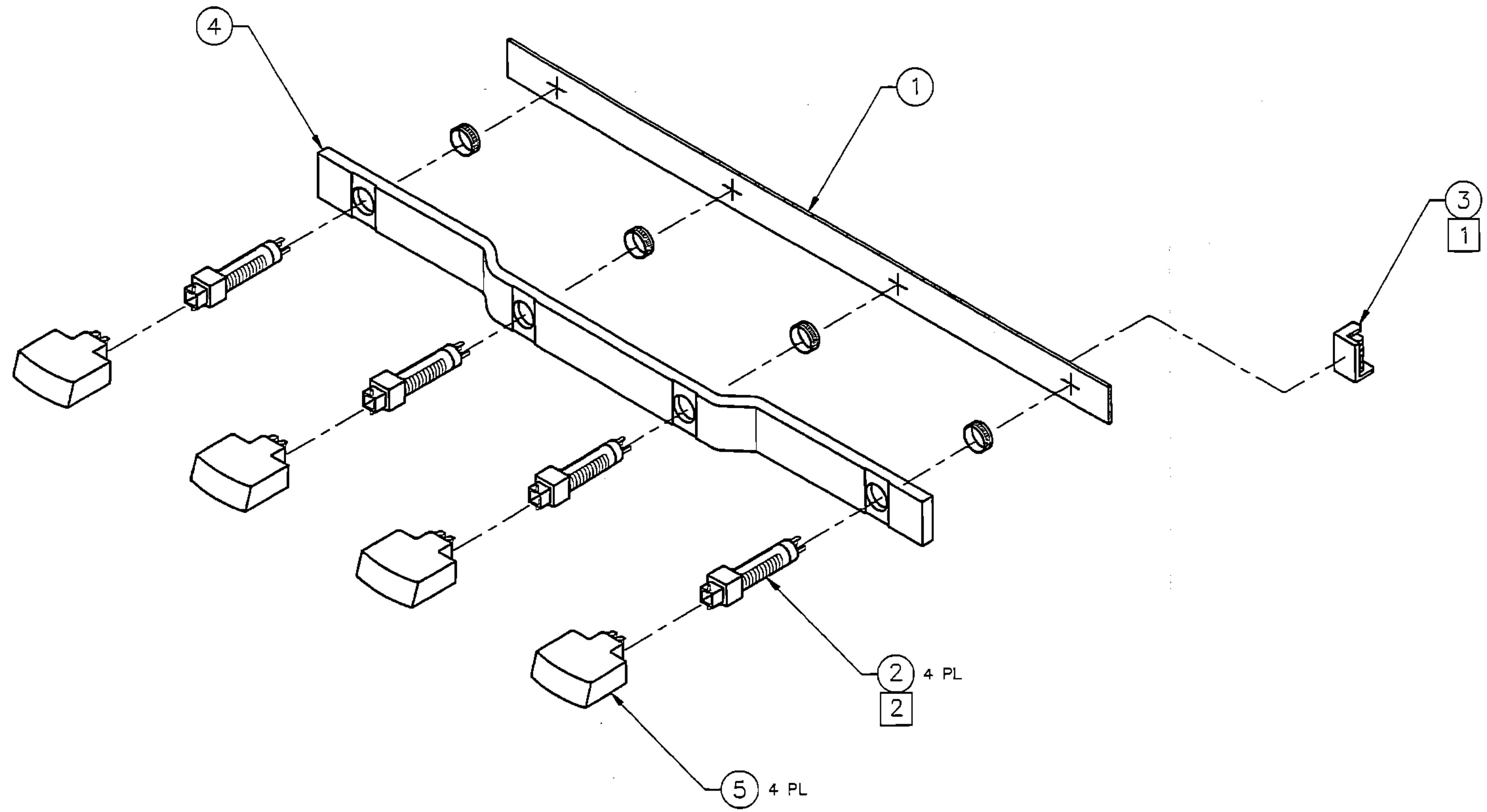
BILL OF MATERIAL

AS OF 12/06/90

23712 **SOFT KEY SWITCH BOARD ASSEMBLY**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
23710	SCH SOFTKEY SWITCH BOARD	A	0	.000
23711	PCB, SOFTKEY SWITCH BOARD	A	1	1.000
18125	SWITCH, MINI PUSHBUTTON, CVS	A1	2	4.000
23895	HDR, 6 POS MICROMODUL	A	3	1.000
23668	BRACKET, SOFTKEY SWITCH,128XP	XA	4	1.000
23551	ACTUATOR, SOFTKEY, 128XP	XA	5	4.000

REV.	ZONE	ECO NO.	REVISIONS-DESCRIPTION	DRFT	APPROVED	DATE
A		03125	PROD REL	TR		



REV. A
SH. 1
DWG. NO. 23712

2 GOLD PIN ON SWITCH THAT IS MARKED "3" SHOULD BE INSTALLED ON BOTTOM OF BOARD.

1 WIDE TAB DENOTES PIN 1.

NOTES: UNLESS OTHERWISE SPECIFIED.

Figure 9-10
Softkey Switch Board Assembly

Bill of Materials and Engineering Drawing:

I/O Panel Assembly, CDI, Domestic

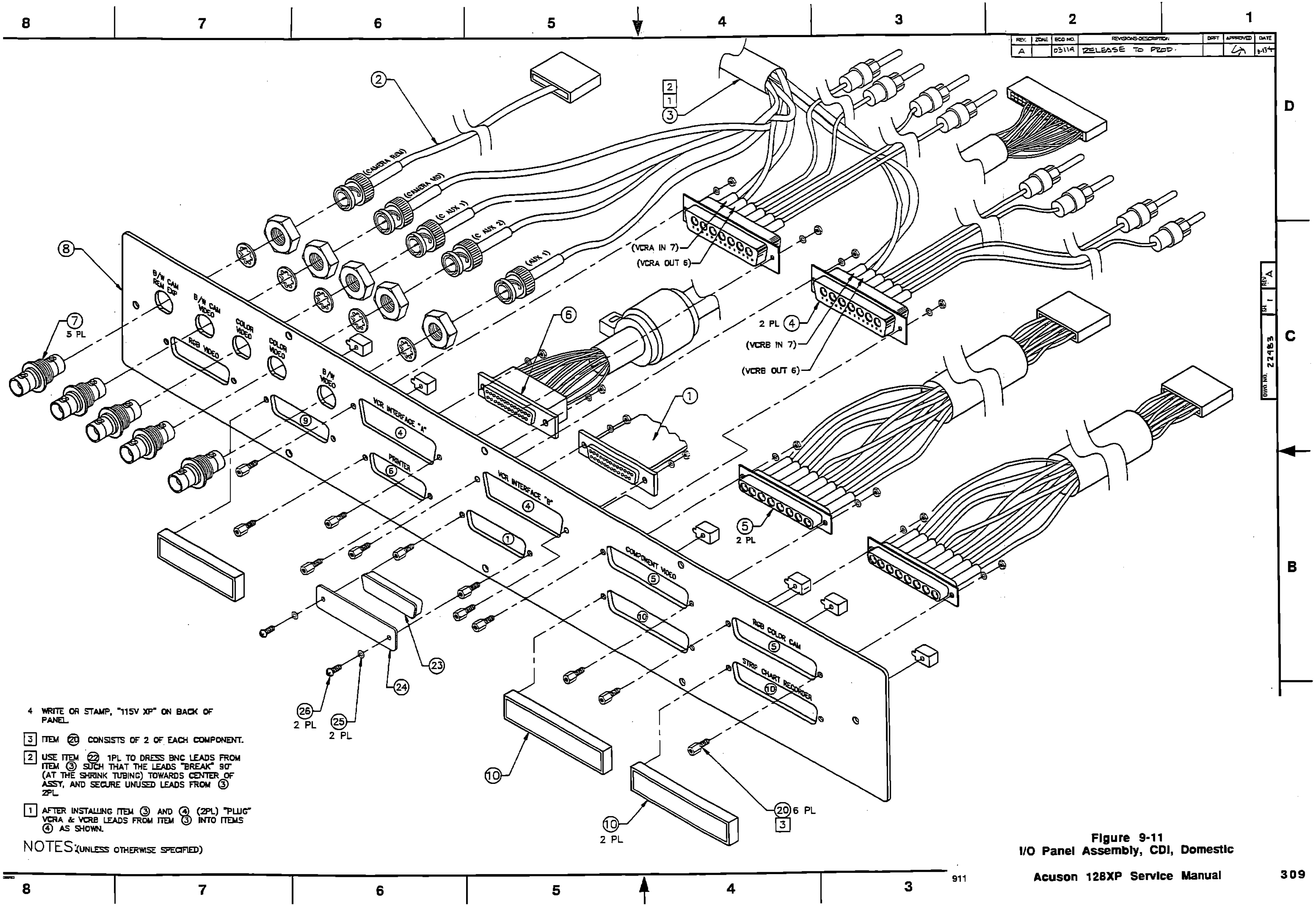
See Next Page

BILL OF MATERIAL

AS OF 12/06/90

22483 I/O PANEL ASSEMBLY, CDI, DOMESTIC

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
25375	CABLE ASSY, SERIAL PORT	XA	1	1.000
17962	CABLE ASSY, MIC REM,INT,(FLOW)	B	2	1.000
17963	CABLE ASSY,COMPOSITE VID, FLOW	D	3	1.000
17964	CABLE ASSY, VCR INTF (FLOW)	D	4	2.000
17965	CABLE ASSY, VIDEO PERIPH, FLOW	A	5	2.000
18050	CABLE ASSY,PRNTR INTRFACE FLOW	E	6	1.000
18479	CONN, BNC FEED-THRU, F-F, ISO	A	7	5.000
24057	PANEL, CDI I/O, XP	A	8	1.000
11395	COVER, CONN-CUTOUT 810-25	A	9	1.000
11394	COVER, CONN CUTOUT 810-37	E	10	2.000
11134	SCREWLOCK KIT, D-SUBMIN	A	20	6.000
11721	CABLE TIE, 3/4 DIA	A	22	3.000
25631	COVER, 25 POS D-SUB SOCKET	A	23	1.000
25658	COVER, SERIAL PORT	A	24	1.000
12500	WASHER NYLON #4	A	25	2.000
12284	SCR, 4-40X1/4 PH PN STD ZN	A	26	2.000



4 WRITE OR STAMP, "115V XP" ON BACK OF PANEL.

[3] ITEM (20) CONSISTS OF 2 OF EACH COMPONENT.

[2] USE ITEM (22) 1PL TO DRESS BNC LEADS FROM ITEM (3) SUCH THAT THE LEADS "BREAK" 90° (AT THE SHRINK TUBING) TOWARDS CENTER OF ASSY, AND SECURE UNUSED LEADS FROM (3) 2PL.

[1] AFTER INSTALLING ITEM (3) AND (4) (2PL) "PLUG" VCRA & VCRB LEADS FROM ITEM (3) INTO ITEMS (4) AS SHOWN.

NOTES:(UNLESS OTHERWISE SPECIFIED)

Figure 9-11
I/O Panel Assembly, CDI, Domestic

Bill of Materials and Engineering Drawing:

Upper Cart Power Supply

See Next Page

BILL OF MATERIAL

AS OF 12/06/90

16894 **UPPER CART POWER SUPPLY**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
17844T	P.S., SCAN CONV 24V MOD TESTED	B	1	1.000
16891	FAN, 3 5/8-INCH 24 VOLT	A	2	2.000
11879	GROMMET EDGING, CATERPILLAR	B	3	5.000
19441	COVER, SC 5V PS PH2	B	4	1.000
21584	CHASSIS, SC5V PS PH2	C	5	1.000
17112	HARNESS, SC HI CURRENT 5 V	B	6	1.000
17111	HARNESS, SC HI CURRENT RETURN	B	7	1.000
17114	FINGER GUARD--SMALL 3.13	1	8	2.000
21237	SCR, 6-32x7/8 PH PN ZN	A	9	8.000
13785	WSHR, LOCK, #6 INT'L TOOTH	1	10	5.000
11866	KEPNUT, 6-32 STEEL ZNC	A	11	8.000
13773	SCR, 6-32X1/4 PH PN NYP	1	12	15.000
13775	SCR,6-32X3/8 PH PN NYP	1	13	5.000
13633	WSHR, #8 INT'L TOOTH ZN	1	14	13.000
11888	RECPT, 3 POS MOLEX, .093	A	15	1.000
16368	TERM F CRMP .093"D 20-14AWG	A	16	2.000
11721	CABLE TIE, 3/4 DIA	A	17	2.000
12677	SCR, 8-32X3/8 PH PN NYPATCH ZN	A	18	13.000
11871	WSHR, #10 FLAT ZN SAE	A	20	2.000
11873	SCR, 10-32X1/2 PH PN STD ZN	A	21	2.000
11943	WASHER,#10 SPLIT LOCK, ZINC	A	22	2.000
21583	BRKT, FAN MTG, SC5V PS PH2	B	23	1.000
12143	WSHR, #6 FLAT ZN	A	25	23.000

REV.	ZONE	ECO NO.	REVISIONS-DESCRIPTION	DRFT	APPROVED	DATE
F		02076	DRAWN AND REVISED PER ECO		[illegible]	[illegible]
H		02613	BOM CHG ONLY		[illegible]	[illegible]
J		03205	REV PER ECO		[illegible]	[illegible]

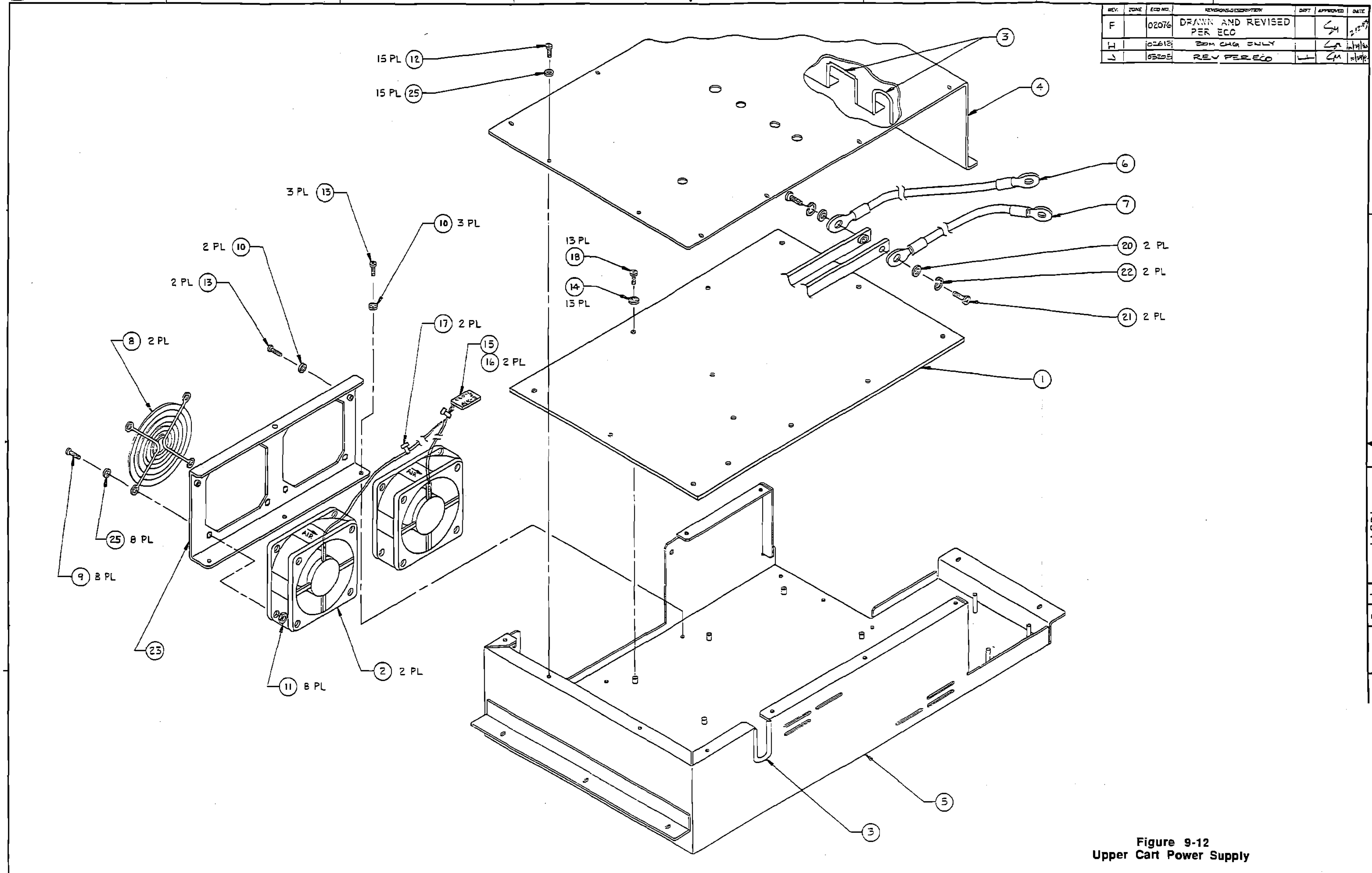


Figure 9-12
Upper Cart Power Supply

BILL OF MATERIAL

AS OF 12/06/90

21027 SCANNER CHASSIS ASSEMBLY

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
11167	PIN CAP, 6 POS MNL	A	1	1.000
11168	TERM M CRMP .130"D 20-14AWG	A	2	5.000
17435	SCR, 8-32x2.5 PH PN NYPATCH ZN	A	3	6.000
18480	FAN, 6 INCH, 12 VOLT, W/TACH	A	4	3.000
13753	TIE MOUNT, CABLE	1	5	3.000
10362	PCB ASSY SMB	7	6	1.000
10980	BLOCK-BUS BAR SUPPORT	2	7	1.000
10981	POWER BUS-SCANNER	A	8	1.000
10982	RETURN BUS-SCANNER	A	9	1.000
11490	SCR, 8-32X.25 PH PN STD ZN	A	10	62.000
12679	SCR, 8-32X3/4 PH PN NYPATCH ZN	B	11	1.000
11553	FINGER GUARD, 6" FAN	A	12	3.000
11875	KEPNUT, 8-32 STEEL ZNC	B	13	9.000
14665	BRACKET, BOTTOM COVER, AL	B	18	1.000
14745	ASSY, S/M SCANNER CHASSIS, AL	J	19	1.000
14886	FLOW STRAIGHTENER,HONEYCOMB,II	A	20	1.000
16419	PLASTIC INSERT, EDGE	A	21	4.000
16581	GROUNDING STRIP,MOD,TOP COVER	B	22	1.000
16979	SCR, 6-32x5/8 PH PN NYPATCH ZN	A	23	5.000
11721	CABLE TIE, 3/4 DIA	A	24	5.000
17805	SCR, 8-32x5/8 PH PN NYPATCH 2N	A	25	5.000
24390	SHLDG EMI SCNR 6" L X.25"	XA	28	4.000
24391	SHLDG EMI SCNR 17."L X.25" H	XA	29	2.000
11721	CABLE TIE, 3/4 DIA	A	30	3.000
12278	WSHR, #6 NYLON	A	31	5.000
23905	ASSY, BAFFLE/FAN DRVR, PH 2B	XD	33	1.000
10392T	ASSY, TSTD DIST BD L	A	34	1.000
22192T	ASSY, TSTD DBR III	A	35	1.000
22642T	ASSY, TSTD TDI III	A	36	1.000
21174	SCR 8-32x3/8 w/CAPTIVE LKWSHR	A	37	62.000
12680	SCR, 8-32X7/8 PH PN NYPATCH ZN	A	38	3.000
11871	WSHR, #10 FLAT ZN SAE	A	39	4.000
13633	WSHR, #8 INT'L TOOTH ZN	1	40	7.000
12678	SCR, 8-32X1/2 PH PN NYPATCH ZN	A	41	21.000
12099	WSHR, #8 FLAT ZN	1	42	26.000
12099	WSHR, #8 FLAT ZN	1	42	26.000
21173	SCR 10-32x3/8 w/CAPTIVE LKWSHR	A	43	8.000
16671	SCR, 8-32X5/8 PH PN SQ-CONESEM	A	44	20.000
12098	SCR, 4-40X1/2 PH PN STD ZN	1	45	8.000
12074	LKWSHR, #4 SPLIT STEEL ZNC	1	46	8.000
12070	WSHR, #4 FLAT ZN	A	47	8.000
14382	SCR,6X32X.750 PH STD ZN	A	48	4.000

21027 **SCANNER CHASSIS ASSEMBLY (CONT.)**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
12143	WSHR, #6 FLAT ZN	A	49	4.000
11901	WASHER, #6 SPLIT LK ZNC	A	50	4.000
25042	CABLE ASSY, SCNR GRND, 6.5"	XB	51	2.000

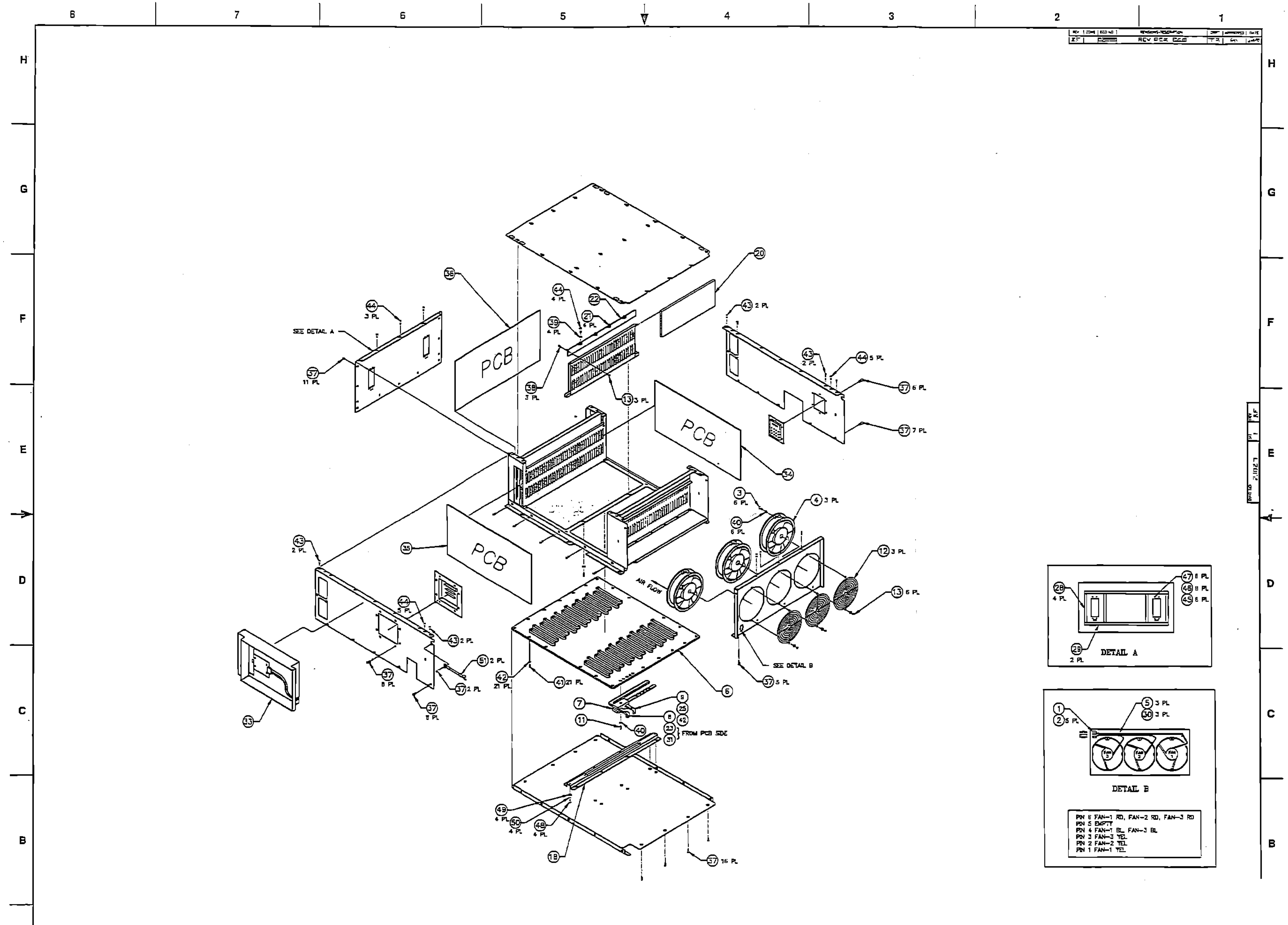


Figure 9-13
Scanner Chassis Assembly

Bill of Materials
and
Engineering Drawing:

Baffle/Fan Driver Board Assembly

See Next Page

BILL OF MATERIAL

AS OF 12/06/90

23905 BAFFLE/FAN DRIVER BOARD ASSEMBLY

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
23739	BAFFLE,RT,SCANNER,XP	A	1	1.000
18782T	ASSY, TSTD FDB	A	2	1.000
18856	HARNESS, SCANNER FAN DRIVER	XB	3	1.000
18565	SCR, 6-32x1/2 PH PN NYPATCH ZN	A	5	4.000
12143	WSHR, #6 FLAT ZN	A	6	4.000

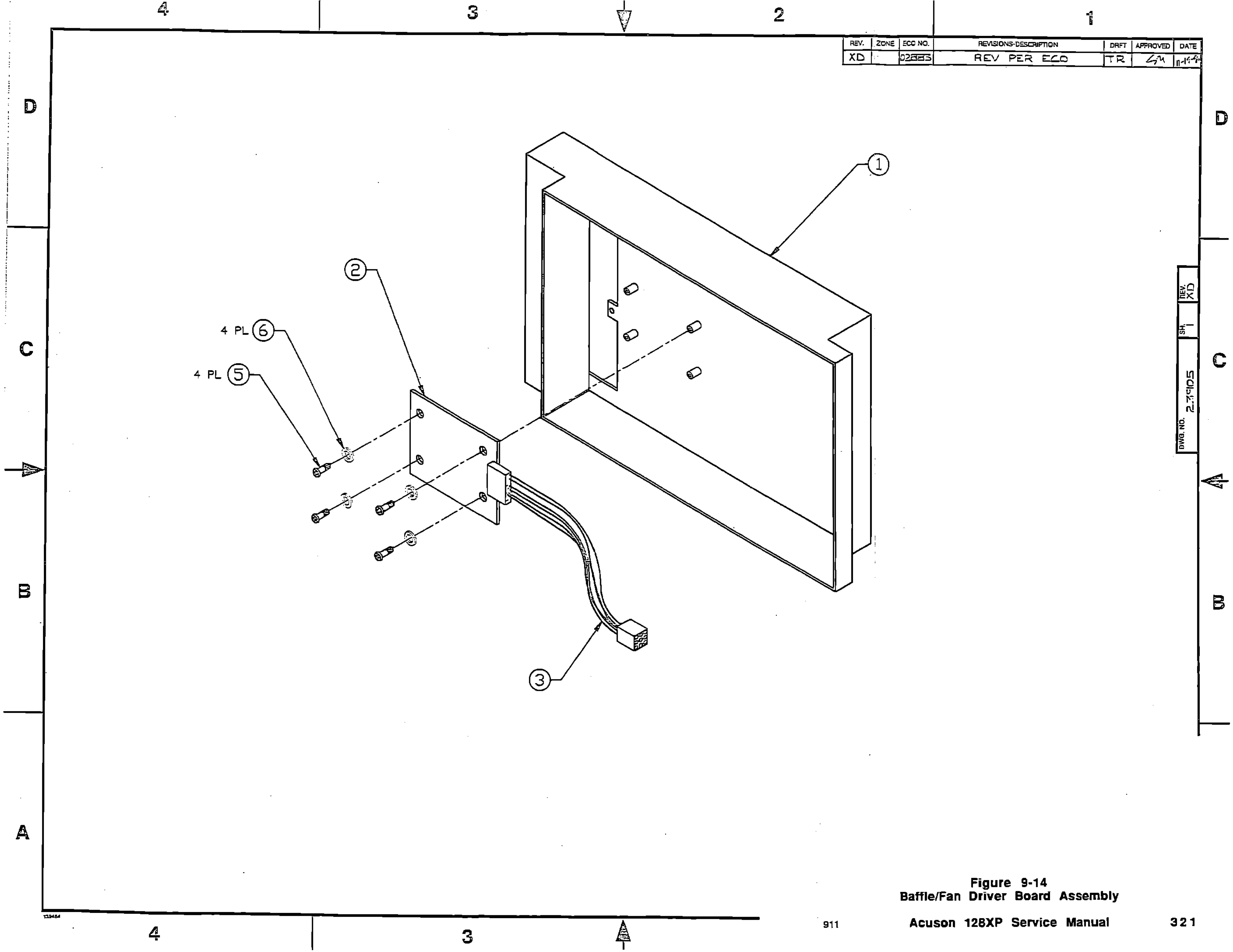


Figure 9-14
Baffle/Fan Driver Board Assembly

BILL OF MATERIAL

AS OF 12/06/90

20865 **POWER SUPPLY TRAY ASSEMBLY, DOMESTIC**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
16863	XFMR PWR ISOLN PH2 DOM 2KVA	F	1	1.000
19141	IND PWR HV BUS 2 INTL	E	2	1.000
19060	ADAPTOR, HV BUS IND. TO TRAY	A	3	.000
16860	CAP ALUM J 2200UF 450V	A	6	1.000
16908	CLAMP, CAPACITOR 3-IN DIA	A	7	1.000
16914	DIODE BRDGE MDA3506 35 A 600V	A	10	1.000
17461	IND 8MH 4A PH2 PF CORR	E	11	1.000
14594	CAP OIL H 50 UF AC	1	12	2.000
14596	BOOT RUBBER, CAP TERMINALS	1	18	2.000
16916	CLAMP, CAPACITOR	A	19	4.000
*18452T	ASSY, TSTD PDB II	A	29	1.000
*16817T	CHASSIS ASSY, PPS PH.II TESTED	A	30	1.000
18923T	P.S., SNR ANALOG LW RIPPLE TST	A	31	1.000
*20707	ASSY, LPS R-PNL, 115V PH2B	B	32	1.000
*17064	ASSY, SOFTSTART	E	33	1.000
24233	HARNESS, SYS PWR,DC,PH2B/128XP	D	34	1.000
24075	WELD'T, LPS TRAY, XP	A	35	1.000
17191	HARNESS, SOFTSTART TO PDB	L	37	1.000
17193	HARNESS, SOFTSTART TO TERM BLK	C	39	1.000
13782	ASSY, MODIFIED MOV, 130 URMS	4	40	2.000
17942	SW ASSY, ROCKER, PH II, DOM	A	41	1.000
*18504	ASSY,DISCHARGE RESISTOR,PDB II	B	42	1.000
18326	CABLE ASSY, FOOTSWITCH CVS/FLW	D	43	1.000
13753	TIE MOUNT, CABLE	1	44	25.000
17084	CLAMP TIE, #10	A	45	3.000
17582	CABLE TIE, 2 INCH DIA	A	46	12.000
17275	TERMINAL BLK, 8 POS 9/16 DBL	1	47	2.000
20265	JUMPER, TERM BLK, OVER-BARRIER	A	48	4.000
13451	BUSHING, LOAD BEARING	A1	49	2.000
11721	CABLE TIE, 3/4 DIA	A	50	37.000
19140	STNDF, ALUM 6-32 1/4 HEX .500L	A	51	2.000
17271	LABEL, TERM BLK 1	B	52	1.000
17272	LABEL, TERMINAL BLK 2	C	53	1.000
11269	WIRE, 14AWG PVC WHT	A	54	.500
11270	WIRE, 14AWG PVC BLK	A	55	3.250
16917	TERM QC F .250 FLAG 18-14AWG	1	56	6.000
12750	CABLE CLAMP CUSIONED METAL	B	57	1.000
11865	NUT, 10-32 KEP ZN	A	58	9.000
13773	SCR, 6-32X1/4 PH PN NYP	1	60	16.000
13773	SCR, 6-32X1/4 PH PN NYP	1	60	16.000
12286	SCR, 10-32X7/8 SKT	A	61	8.000
12677	SCR, 8-32X3/8 PH PN NYPATCH ZN	A	62	20.000

20865 POWER SUPPLY TRAY ASSEMBLY, DOMESTIC (CONT.)

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
13633	WSHR, #8 INT'L TOOTH ZN	1	64	33.000
12099	WSHR, #8 FLAT ZN	1	65	35.000
11716	WASHER, 1/4 SPLIT LK ZNC	A	66	8.000
12120	WSHR, 1/4 FLAT ZN	B	67	8.000
13259	WSHR, #10 INT'L TOOTH ZINC	A	68	9.000
11871	WSHR, #10 FLAT ZN SAE	A	69	9.000
13785	WSHR, LOCK, #6 INT'L TOOTH	1	70	13.000
12143	WSHR, #6 FLAT ZN	A	71	3.000
17805	SCR, 8-32x5/8 PH PN NYPATCH ZN	A	72	10.000
11875	KEPNUT, 8-32 STEEL ZNC	B	73	2.000
24538	TERM LKFK #8 16-14AWG INSL GRP	A	74	2.000
26125	TERM QC DCRMP250x032 12-10AWG	A	75	1.000
26131	TERM RNG DBL CRMP #10 16-14AWG	A	76	1.000
24548	TERM,RING#10 12-10AWG INSL GRP	A	77	2.000
26128	TERM QC DCRMP 250x032 16-14AWG	A	79	1.000
12673	SCR, 4-40X3/8 PH PN NYPATCH ZN	A	80	2.000
12164	WSHR, #4 LK INT TOOTH ZN	1	81	2.000
11277	WIRE, 16AWG PVC WHT/BLK	A	82	1.500
12278	WSHR, #6 NYLON	A	85	5.000
12683	SCR,10-32X1/2 PH PN NYPATCH ZN	A	86	5.000
23511	SCR, 1/4-20x1.375, SOC HD SS	A	87	4.000
16826	CONN, 2 POS PLUG MNL	A	89	1.000
11165	TERM F CRMP .084"D 20-14AWG	A	90	2.000
22670	DIAGRAM, DC WIRING, PH2B	A	91	.000
*18242	PCB ASSY HV BUS WARN INDICATE	C	92	1.000
18320	LABEL, PAHSE II PWR SPLY WRNG	A	93	1.000
19297	HARNESS, HV BUS TO PDB II	B	94	1.000
22650	DIAGRAM,AC WIRING,PH2B DOM	B	96	.000
20264	COVER, TERM BLK, 8 POS, CLEAR	A	97	2.000
20390	BANANA PLUG W/8-32X5/8 STUD	A	98	4.000
19405	SPACER, INSUL, SOFTSTART COVER	A	99	4.000
18501	COVER, SOFTSTART ASSY	A	100	1.000
20303	SCR, 8-32x3/8 PH PN NYLON	A	101	4.000
21749	COVER, FUSE-INSULATED PUSH-ON	A	102	2.000
11767	SCREW,8-32x3/8 ALLEN CAP,BLACK	A	103	4.000
21567	LABEL, RFI FILTER MTG(PER CSA)	A	104	1.000
23063	SNDPRFG, WHEEL WELL 1/2" THK	A	105	2.000
23065	GROMMET ISOLATOR, 1/4-20 11LBS	A	107	4.000
23066	FERRULE, PLAIN, 1/4-20 STEEL	A	108	4.000
23067	GROMMET ISOLATOR, #10-4LB RTG	A	109	4.000
23068	FERRULE, PLAIN, 10-32, BRASS	A	110	8.000
23069	GROMMET ISOLATOR, #10-1LB RTG	A	111	4.000
23070	WASHER,FLAT 1/4-20x1.38,STL/ZN	A	112	4.000
23071	WASHER, FLAT,10x1.0,STEEL/ZINC	A	113	8.000
23510	KEPNUT, 1/4-20 STEEL ZNC	A	114	4.000

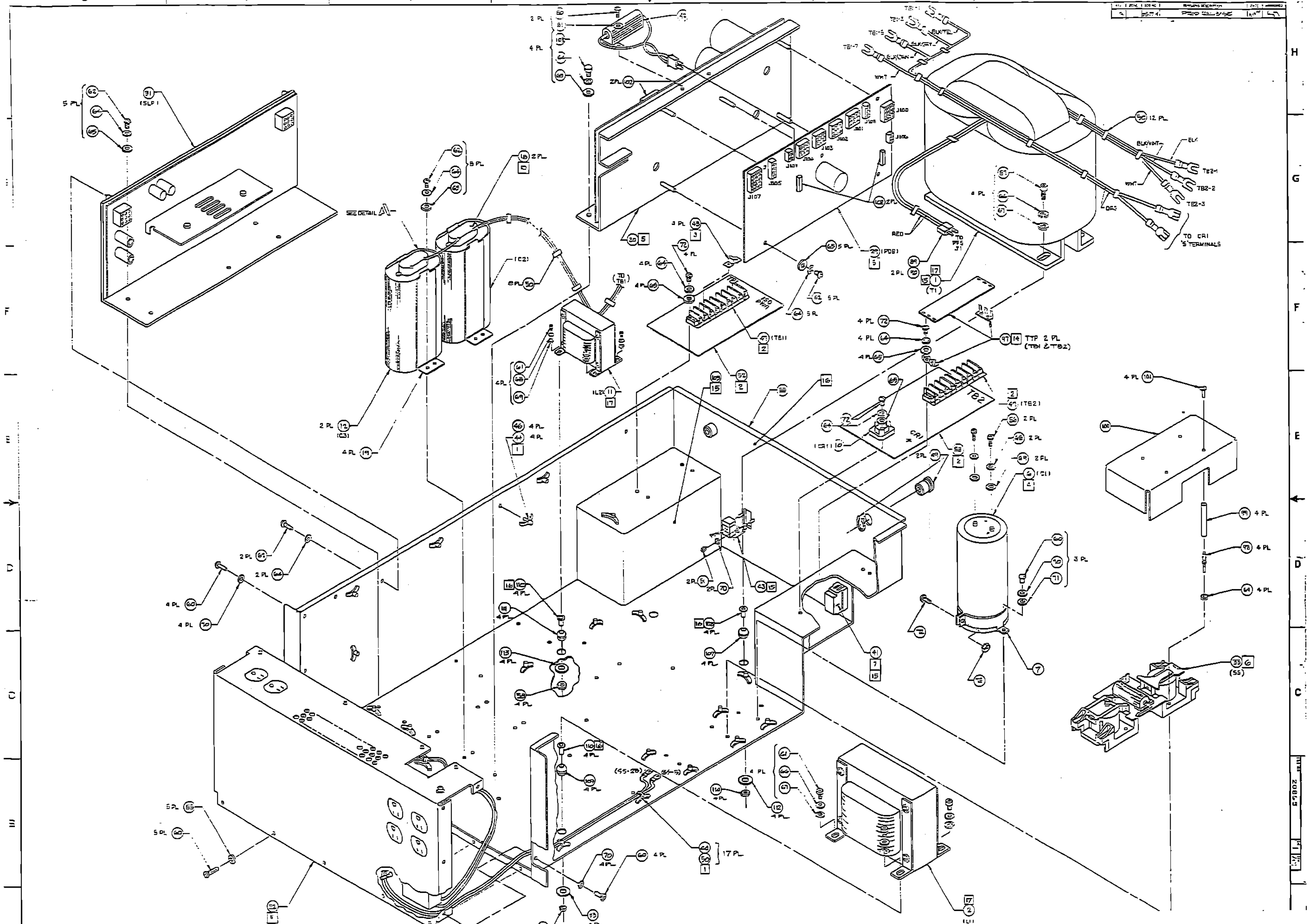
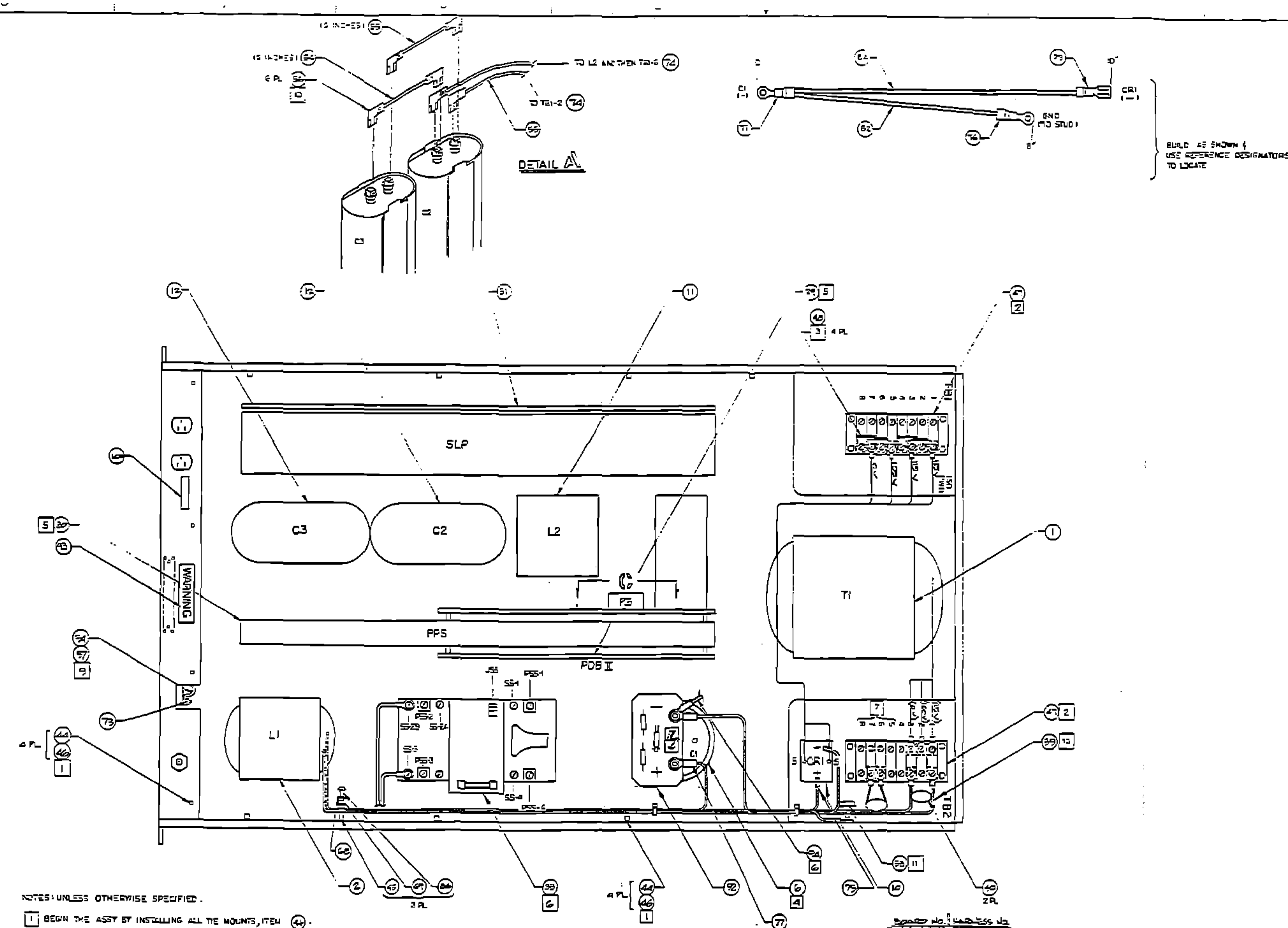


Figure 9-15
Power Supply Tray, Domestic-sheet 1



NOTES: UNLESS OTHERWISE SPECIFIED.

1 BEGIN THE ASSY BY INSTALLING ALL TIE MOUNTS, ITEM 44.

2 LOCATE AND ATTACH THE LABELS BEFORE MOUNTING THE TERMINAL BLOCKS, ITEM 47.

3 LOCATE THE JUMPERS, ITEM 48, ON TB1 AS SHOWN ON THIS PAGE.

4 INSTALL C1, ITEM 6, AND POSITION THE TERMINALS AS SHOWN ON THIS PAGE.

5 CONNECT ITEM 29 TO ITEM 32 BEFORE INSTALLING INTO THE TRAY.

6 USE THE HARNESS DRAWINGS FOR ITEMS 34, 37, 39, & 94 TO SHOW, HOW AND WHERE THEY SHOULD BE LOCATED AND TERMINATED.

7 WHEN INSTALLING ITEM 41 USE DRAWING [illegible] TERMINATIONS.

9 WHEN INSTALLING ITEM 32 USE DRAWINGS 17791, 18322 & 20343 TO DETERMINE THE WIRE TERMINATIONS.

8 AFTER SECURING ITEM 34 TO 35 CONNECT THE GRN/YEL WIRE & THE HI-POT JACK TO THE REAR PANEL & PLUG IN THE FAN.

10 PUSH THE WIRES THROUGH ITEM 18 BEFORE CONNECTING TO C2 OR C3.

11 USE ITEM 55 TO ATTACH HARNESS TO TO GND STUD.

12 DO NOT PLUG [illegible] HARNESS. TIEWRAP IT TO OTHER HARNESS AND ATTACH LABEL ITEM 61.

13 INSTALL ITEM [illegible] AND [illegible] AS SHOWN FOR 115 VAC INPUT. MOVE BOTH TO TB3-2 FOR 100 AC INPUT.

14 ITEM 77 CONSISTS OF 3 PARTS: ONE COVER & 2 CLIPS AS SHOWN (TYP 2 PL, TB1 & TB2).

15 ATTACH ITEM [illegible] TO BOTH WHEEL WELLS BEFORE INSTALLING ITEMS 1, 41, 42 & [illegible].

16 PUSH THESE FERRULES THROUGH THE CENTER OF EACH GROMMET AFTER THE GROMMETS HAVE BEEN INSERTED INTO THE UPS TRAY.

17 AFTER INSTALLING ITEMS 1, 2 & 11 THE GRN/YEL GROUND WIRES MUST BE ATTACHED AS FOLLOWS: ITEM 1 TO TB1 MOUNTING SCREW.
ITEM 2 TO STUD ON SIDE OF UPS TRAY.
ITEM 11 TO ITEM 31 BASE MOUNTING PLATE SCREW.

Figure 9-16
Power Supply Tray, Domestic-sheet 2

Bill of Materials and Engineering Drawing:

Power Supply Rear Panel Assembly, Domestic

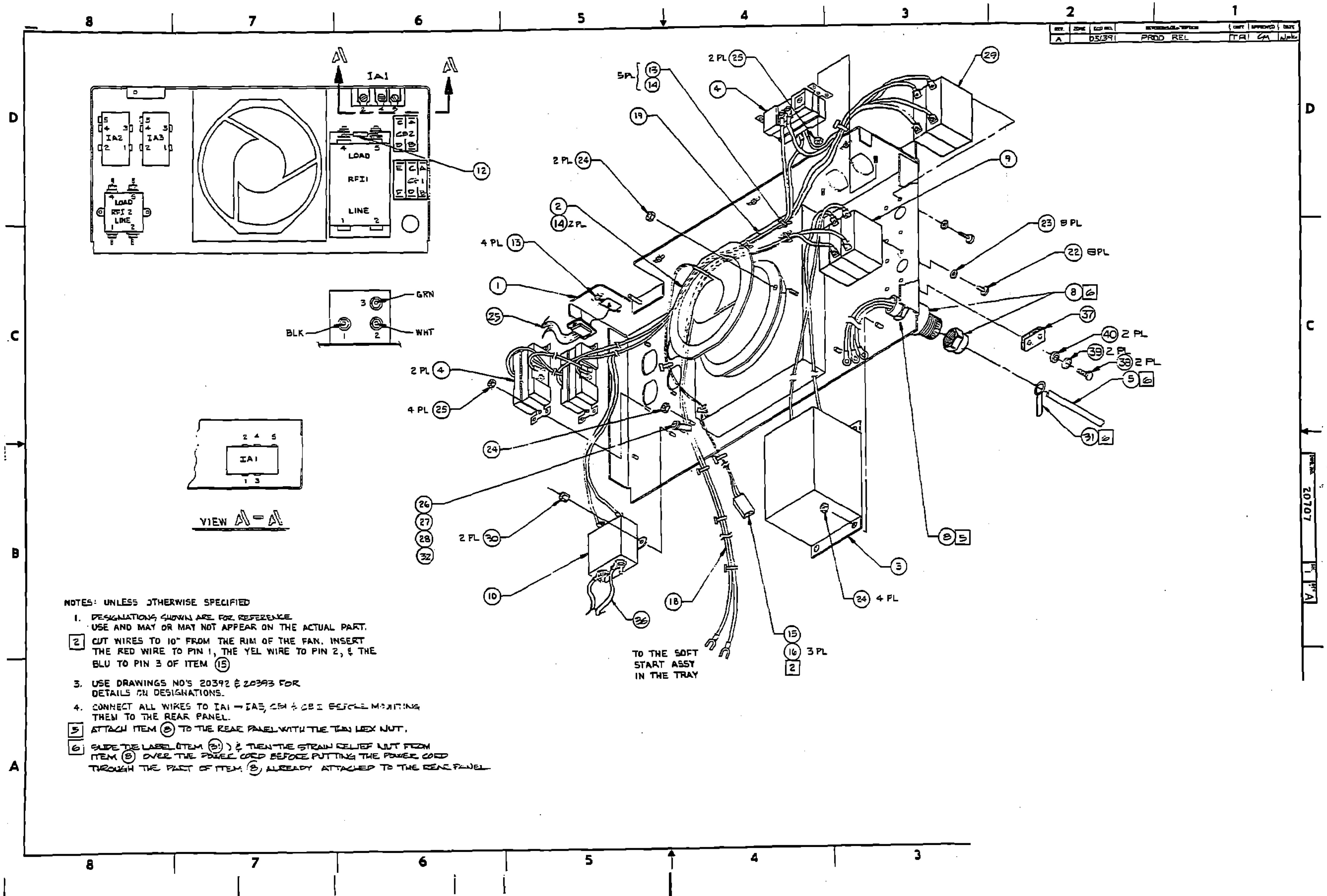
See Next Page

BILL OF MATERIAL

AS OF 1/07/91

20707 **POWER SUPPLY REAR PANEL ASSEMBLY, DOMESTIC**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
24219	WELD'T LPS R-PNL, 115V XP	B	1	1.000
18480	FAN, 6 INCH, 12 VOLT, W/TACH	A	2	1.000
13306	FILTER,CM INPUT	A	3	1.000
13309	RECPT,HOSP GRADE DUPLEX	A	4	3.000
23253	CORD, POWER SUPPLY, 15A, 15FT	B	5	1.000
26093	WSHR, 3/4" LOCK	A	7	1.000
26122	STRAIN RLF, PCC .56-.69	A	8	1.000
24539	OBS-STRAIN RLF, PCC .55-.71	A	8	.000
22931	CKT BKR,15A,2 POLE,AUX TC	A	9	1.000
11255	FILTER, EMI, 10 AMP	A	10	1.000
16776	ASSY, BLEEDER FCI FILT, DOM 1B	B	12	1.000
13753	TIE MOUNT, CABLE	1	13	9.000
11721	CABLE TIE, 3/4 DIA	A	14	7.000
11888	RECPT, 3 POS MOLEX, .093	A	15	1.000
19299	TERM F CRMP .093"D 24-22AWG	A	16	3.000
20393	HARNESS, NON-ISO, 115V PH2B	B	18	1.000
20392	HARNESS, ISO-AC, 115V PH2B	B	19	1.000
13773	SCR, 6-32X1/4 PH PN NYP	1	22	10.000
12278	WSHR, #6 NYLON	A	23	10.000
11875	KEPNUT, 8-32 STEEL ZNC	B	24	7.000
11866	KEPNUT, 6-32 STEEL ZNC	A	25	6.000
17084	CLAMP TIE, #10	A	26	1.000
12683	SCR,10-32X1/2 PH PN NYPATCH ZN	A	27	1.000
11871	WSHR, #10 FLAT ZN SAE	A	28	1.000
22932	CKT BKR,4A,2 POLE,SCR TERM	A	29	1.000
19140	STNDF, ALUM 6-32 1/4 HEX .500L	A	30	2.000
17727	LABEL, SYSTEM POWER CABLE	B	31	1.000
13259	WSHR, #10 INT'L TOOTH ZINC	A	32	1.000
24352	PCB ASSY, LED DISPLAY BOARD	A	35	1.000
18322	HARNESS, ISO-AC TO RFI	F	36	1.000
25719	OBS-KEEPER, STRAIN RELIEF	OB	37	.000
13775	SCR,6-32X3/8 PH PN NYP	1	38	2.000
13785	WSHR, LOCK, #6 INT'L TOOTH	1	39	2.000
12143	WSHR, #6 FLAT ZN	A	40	2.000



NOTES: UNLESS OTHERWISE SPECIFIED

1. DESIGNATIONS SHOWN ARE FOR REFERENCE USE AND MAY OR MAY NOT APPEAR ON THE ACTUAL PART.

2 CUT WIRES TO 10" FROM THE RIM OF THE FAN. INSERT THE RED WIRE TO PIN 1, THE YEL WIRE TO PIN 2, & THE BLU TO PIN 3 OF ITEM 15

3. USE DRAWINGS NO'S 20392 & 20393 FOR DETAILS ON DESIGNATIONS.

4. CONNECT ALL WIRES TO IA1 – IA3, CB1 & CB2 BEFORE MOUNTING THEM TO THE REAR PANEL.

5 ATTACH ITEM 8 TO THE REAR PANEL WITH THE THIN HEX NUT.

6 SLIDE THE LABEL (ITEM 31) & THEN THE STRAIN RELIEF NUT FROM ITEM 8 OVER THE POWER CORD BEFORE PUTTING THE POWER CORD THROUGH THE PART OF ITEM 8 ALREADY ATTACHED TO THE REAR PANEL

Figure 9-17
Power Supply Rear Panel, Domestic

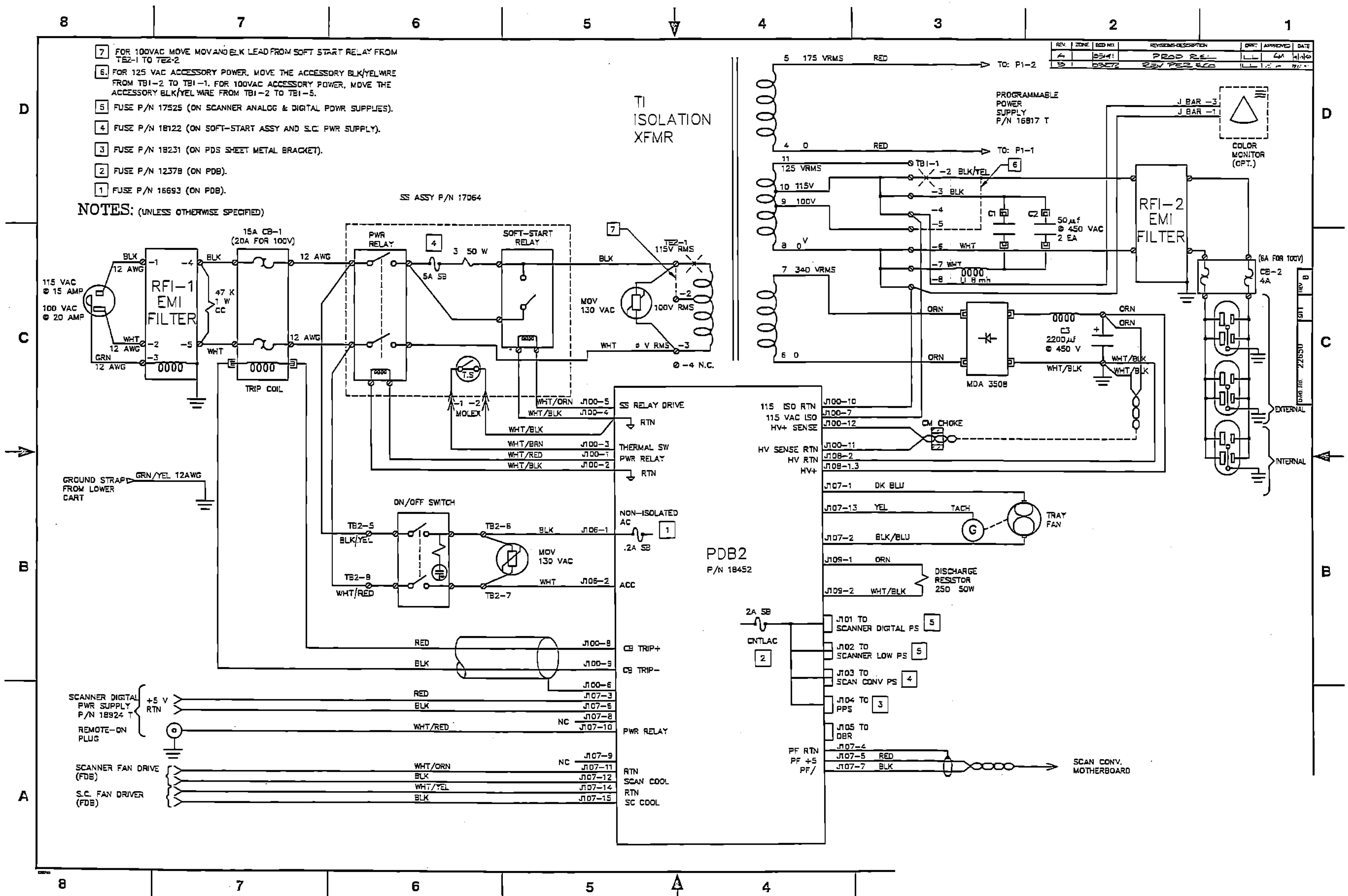


Figure 9-18
AC Power Distribution, Domestic

BILL OF MATERIAL

AS OF 12/06/90

22481 POWER SUPPLY TRAY ASSEMBLY, INTERNATIONAL

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
20154	XFMR PWR ISOLN PH2 EURO (BAL)	E	1	1.000
19141	IND PWR HV BUS 2 INTL	E	2	1.000
19060	ADAPTOR, HV BUS IND. TO TRAY	A	3	.000
16860	CAP ALUM J 2200UF 450V	A	6	1.000
16908	CLAMP, CAPACITOR 3-IN DIA	A	7	1.000
16914	DIODE BRDGE MDA3506 35 A 600V	A	10	1.000
17461	IND 8MH 4A PH2 PF CORR	E	11	1.000
14594	CAP OIL H 50 UF AC	1	12	2.000
14596	BOOT RUBBER, CAP TERMINALS	1	18	2.000
16916	CLAMP, CAPACITOR	A	19	4.000
*18452TI	PCB ASSY, PDB II, TSTD, INT'L	B	29	1.000
*16817T	CHASSIS ASSY, PPS PH.II TESTED	A	30	1.000
18923T	P.S., SNR ANALOG LW RIPPLE TST	A	31	1.000
*22482	ASSY, LPS R-PNL, 220V PH2B	A	32	1.000
*17836	ASSY, SOFTSTART, INT'L	D	33	1.000
24233	HARNESS, SYS PWR,DC,PH2B/128XP	D	34	1.000
24075	WELD'T, LPS TRAY, XP	A	35	1.000
17191	HARNESS, SOFTSTART TO PDB	L	37	1.000
17193	HARNESS, SOFTSTART TO TERM BLK	C	39	1.000
13772	ASSY, MODIFIED MOV, 275 URMS	4	40	2.000
17929	ASSY, ROCKER SW PH2, INT'L	A	41	1.000
*18504	ASSY,DISCHARGE RESISTOR,PDB II	B	42	1.000
18326	CABLE ASSY, FOOTSWITCH CVS/FLW	D	43	1.000
13753	TIE MOUNT, CABLE	1	44	25.000
17084	CLAMP TIE, #10	A	45	3.000
17582	CABLE TIE, 2 INCH DIA	A	46	12.000
17275	TERMINAL BLK, 8 POS 9/16 DBL	1	47	2.000
20265	JUMPER, TERM BLK, OVER-BARRIER	A	48	4.000
13451	BUSHING, LOAD BEARING	A1	49	2.000
11721	CABLE TIE, 3/4 DIA	A	50	37.000
19140	STNDF, ALUM 6-32 1/4 HEX .500L	A	51	2.000
17941	LABEL, TERMINAL BLK 1, INT'L	C	52	1.000
17940	LABEL, TERMINAL BLK 2, INT'L	C	53	1.000
11269	WIRE, 14AWG PVC WHT	A	54	.500
11270	WIRE, 14AWG PVC BLK	A	55	3.250
16917	TERM QC F .250 FLAG 18-14AWG	1	56	6.000
12750	CABLE CLAMP CUSIONED METAL	B	57	1.000
11865	NUT, 10-32 KEP ZN	A	58	9.000
13773	SCR, 6-32X1/4 PH PN NYP	1	60	16.000
13773	SCR, 6-32X1/4 PH PN NYP	1	60	16.000
12286	SCR, 10-32X7/8 SKT	A	61	8.000
12677	SCR, 8-32X3/8 PH PN NYPATCH ZN	A	62	20.000

22481 **POWER SUPPLY TRAY ASSEMBLY, INTERNATIONAL, (Cont.)**

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
13633	WSHR, #8 INT'L TOOTH ZN	1	64	33.000
12099	WSHR, #8 FLAT ZN	1	65	35.000
11716	WASHER, 1/4 SPLIT LK ZNC	A	66	8.000
12120	WSHR, 1/4 FLAT ZN	B	67	8.000
13259	WSHR, #10 INT'L TOOTH ZINC	A	68	9.000
11871	WSHR, #10 FLAT ZN SAE	A	69	9.000
13785	WSHR, LOCK, #6 INT'L TOOTH	1	70	13.000
12143	WSHR, #6 FLAT ZN	A	71	3.000
17805	SCR, 8-32x5/8 PH PN NYPATCH 2N	A	72	10.000
11875	KEPNUT, 8-32 STEEL ZNC	B	73	2.000
24538	TERM LKFK #8 16-14AWG INSL GRP	A	74	2.000
26125	TERM QC DCRMP250x032 12-10AWG	A	75	1.000
26131	TERM RNG DBL CRMP #10 16-14AWG	A	76	1.000
24548	TERM,RING#10 12-10AWG INSL GRP	A	77	2.000
26128	TERM QC DCRMP 250x032 16-14AWG	A	79	1.000
12673	SCR, 4-40X3/8 PH PN NYPATCH ZN	A	80	2.000
12164	WSHR, #4 LK INT TOOTH ZN	1	81	2.000
11277	WIRE, 16AWG PVC WHT/BLK	A	82	1.500
12278	WSHR, #6 NYLON	A	85	5.000
12683	SCR,10-32X1/2 PH PN NYPATCH ZN	A	86	5.000
23511	SCR, 1/4-20x1.375, SOC HD SS	A	87	4.000
16826	CONN, 2 POS PLUG MNL	A	89	1.000
11165	TERM F CRMP .084"D 20-14AWG	A	90	2.000
22670	DIAGRAM, DC WIRING, PH2B	A	91	.000
*18242	PCB ASSY HV BUS WARN INDICATE	C	92	1.000
19297	HARNESS, HV BUS TO PDB II	B	94	1.000
22660	DIAGRAM, AC WIRING, PH2B,220V	B	96	.000
20264	COVER, TERM BLK, 8 POS, CLEAR	A	97	2.000
20390	BANANA PLUG W/8-32X5/8 STUD	A	98	4.000
19405	SPACER, INSUL, SOFTSTART COVER	A	99	4.000
18501	COVER, SOFTSTART ASSY	A	100	1.000
20303	SCR, 8-32x3/8 PH PN NYLON	A	101	4.000
21749	COVER, FUSE-INSULATED PUSH-ON	A	102	2.000
11767	SCREW,8-32x3/8 ALLEN CAP,BLACK	A	103	4.000
21567	LABEL, RFI FILTER MTG(PER CSA)	A	104	1.000
23063	SNDPRFG, WHEEL WELL 1/2" THK	A	105	2.000
23065	GROMMET ISOLATOR, 1/4-20 11LBS	A	107	4.000
23066	FERRULE, PLAIN, 1/4-20 STEEL	A	108	4.000
23067	GROMMET ISOLATOR, #10-4LB RTG	A	109	4.000
23068	FERRULE, PLAIN, 10-32, BRASS	A	110	8.000
23069	GROMMET ISOLATOR, #10-1LB RTG	A	111	4.000
23070	WASHER,FLAT 1/4-20x1.38,STL/ZN	A	112	4.000
23071	WASHER, FLAT,10x1.0,STEEL/ZINC	A	113	8.000
23510	KEPNUT, 1/4-20 STEEL ZNC	A	114	4.000

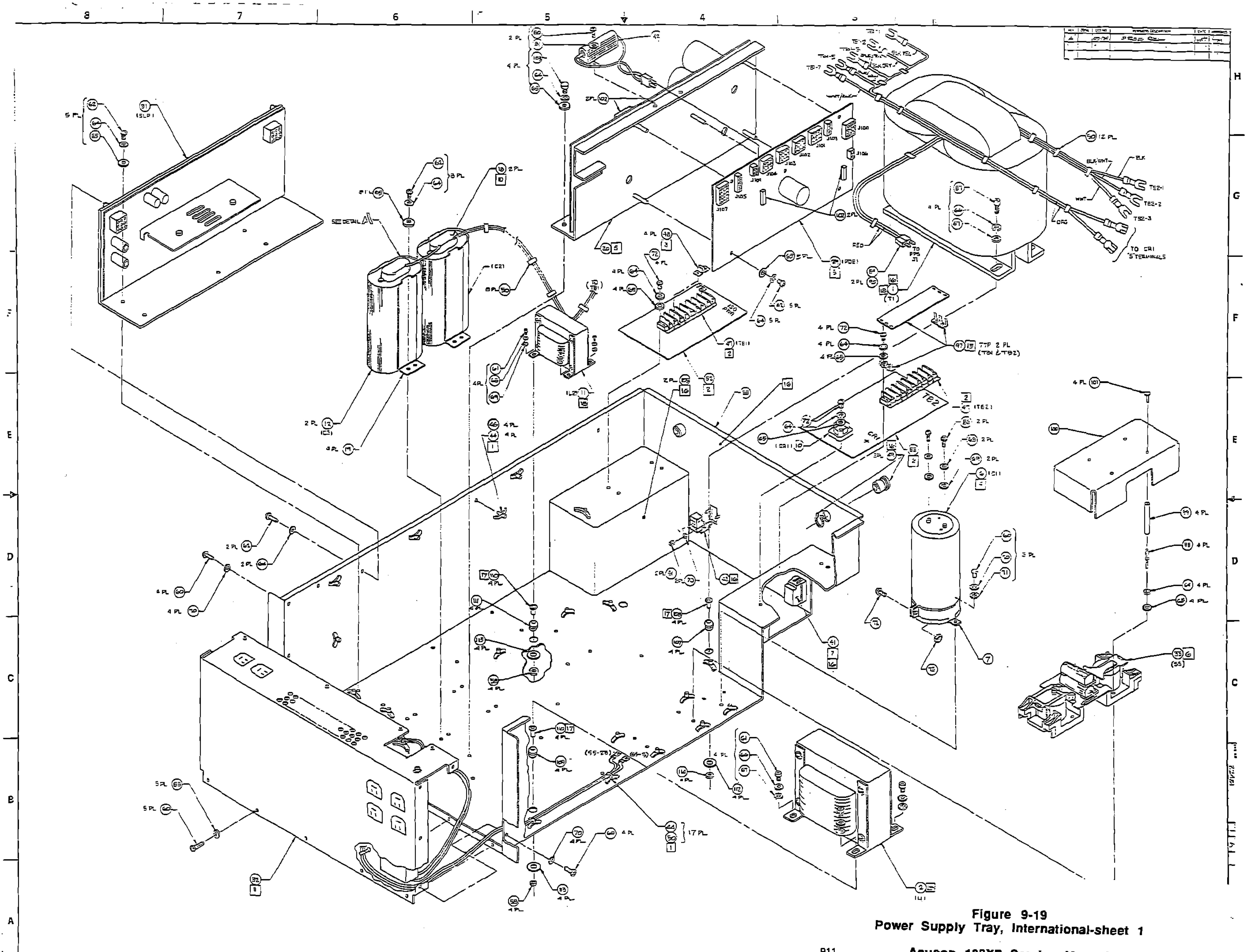
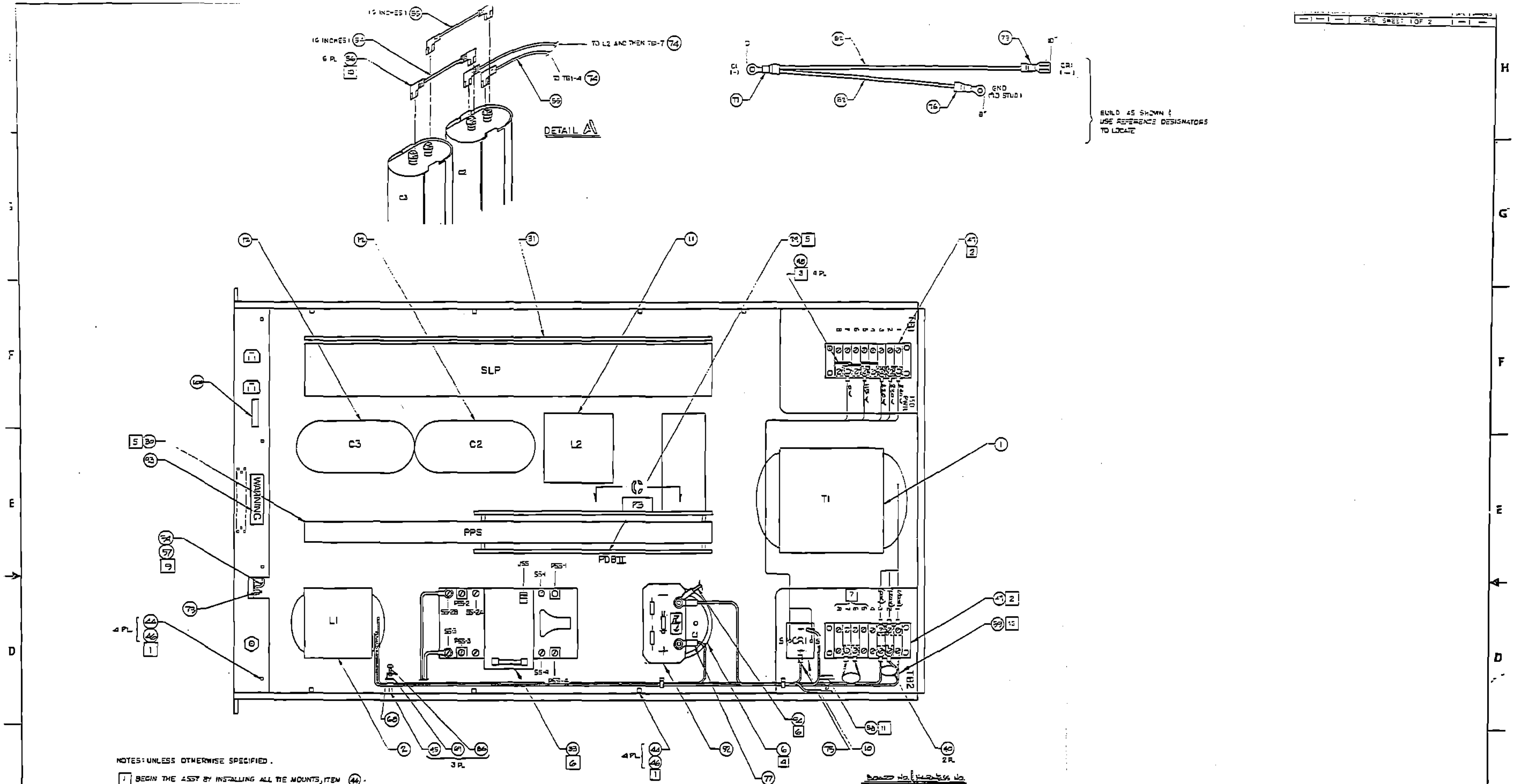
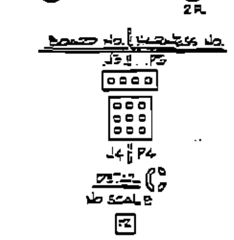


Figure 9-19
Power Supply Tray, International-sheet 1





NOTES: UNLESS OTHERWISE SPECIFIED.

1. BEGIN THE ASSY BY INSTALLING ALL TIE MOUNTS, ITEM 44.
2. LOCATE AND ATTACH THE LABELS BEFORE MOUNTING THE TERMINAL BLOCKS, ITEM 97.
3. LOCATE THE JUMPERS, ITEM 48, ON TB1 AS SHOWN ON THIS PAGE.
4. INSTALL C1, ITEM 6, AND POSITION THE TERMINALS AS SHOWN ON THIS PAGE.
5. CONNECT ITEM 29 TO ITEM 30 BEFORE INSTALLING INTO THE TRAY.
6. USE THE HARNESS DRAWINGS FOR ITEMS 34, 37, 39, & 94 TO SHOW HOW AND WHERE THEY SHOULD BE LOCATED AND TERMINATED.
7. WHEN INSTALLING ITEM 41 USE DRAWING 17942 TERMINATIONS.
8. WHEN INSTALLING ITEM 32 USE DRAWINGS 17151, 19773 & 20554 TO DETERMINE THE WIRE TERMINATIONS.
9. AFTER SECURING ITEM 38 TO 52 CONNECT THE GRN/YEL WIRE & THE 10-POT JACK TO THE REAR PANEL & PLUG IN THE FAN.
10. PUSH THE WIRES THROUGH ITEM 18 BEFORE CONNECTING TO C2 OR C3.
11. USE ITEM 58 TO ATTACH HARNESS TO TO GND STUD.
12. DO NOT PLUG IN F4 HARNESS. TIEWRAP IT TO OTHER HARNESS AND ATTACH LABEL ITEM 91.
13. INSTALL ITEM 59 AND 40 AS SHOWN FOR 220VAC INPUT. MOVE BOTH TO TB2-1 FOR 240VAC INPUT.
14. AFTER PERFORMING NOTE 13 USE THE CORRESPONDING TERMINAL POSITION FOR THE 150VAC POWER (ITEM 95 - BLK WIRE): TB1-1 FOR 240 VAC, TB1-2 FOR 230 VAC, TB1-3 FOR 220 VAC
15. ITEM 97 CONSISTS OF 3 PARTS: ONE COVER & 2 CLIPS AS SHOWN (TYP 2 PL, TB1 & TB2).
16. ATTACH ITEM 103 TO BOTH WHEEL WELLS BEFORE INSTALLING ITEMS 1, 41, 43 & 47.
17. PUSH THESE FERRULES THROUGH THE CENTER OF EACH GROMMET AFTER THE GROMMETS HAVE BEEN INSERTED INTO THE LPS TRAY.
18. AFTER INSTALLING ITEMS 1, 2 & 11 THE GRN/YEL GROUND WIRES MUST BE ATTACHED AS FOLLOWS: ITEM 1 TO TB1 MOUNTING SCREW. ITEM 2 TO STUD ON SIDE OF LPS TRAY. ITEM 11 TO ITEM 2 BASE MOUNTING PLATE SCREW.

Figure 9-20
Power Supply Tray, International-sheet 2

Bill of Materials
and
Engineering Drawing:

Power Supply Rear Panel, International

See Next Page

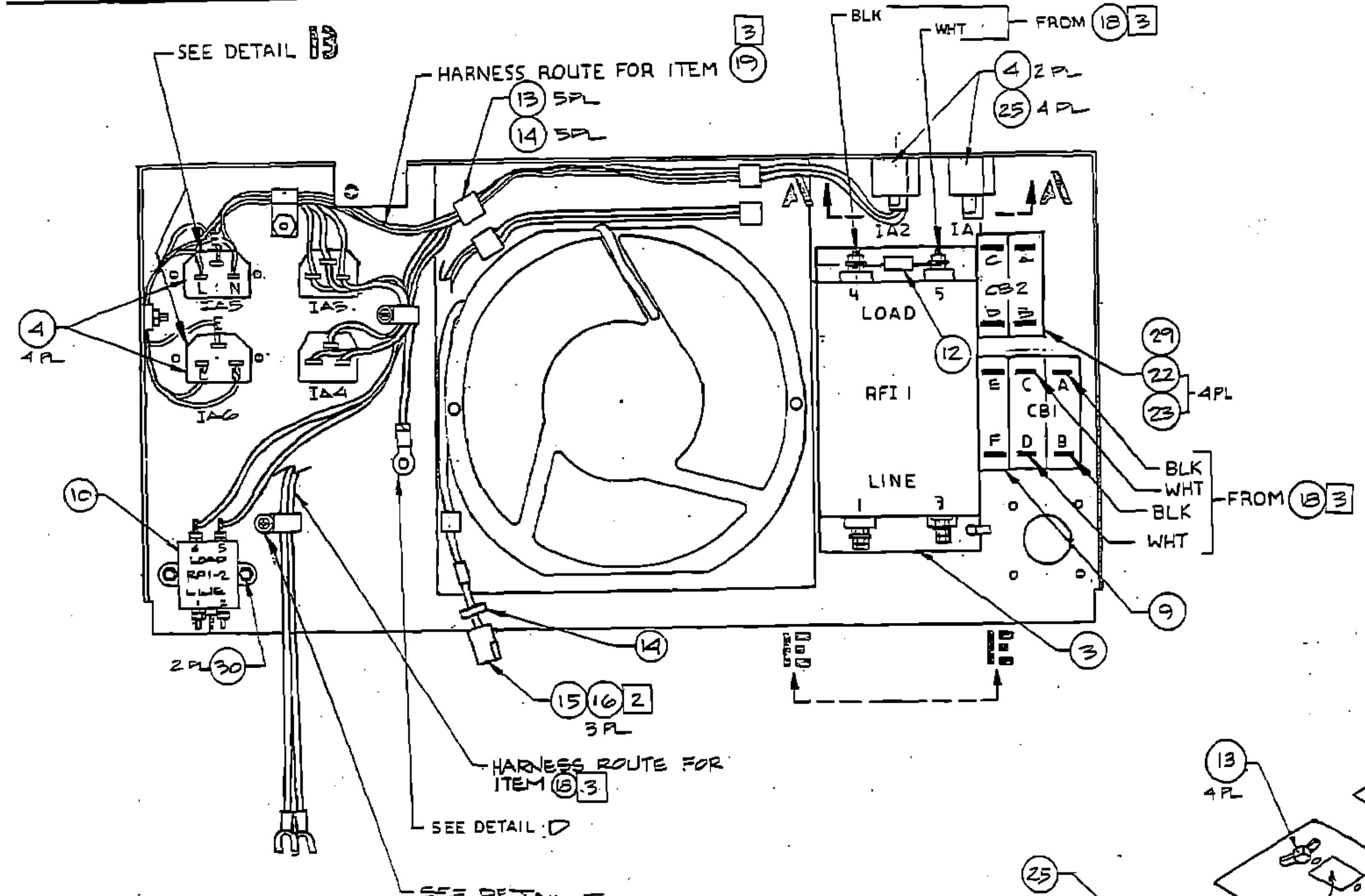
BILL OF MATERIAL

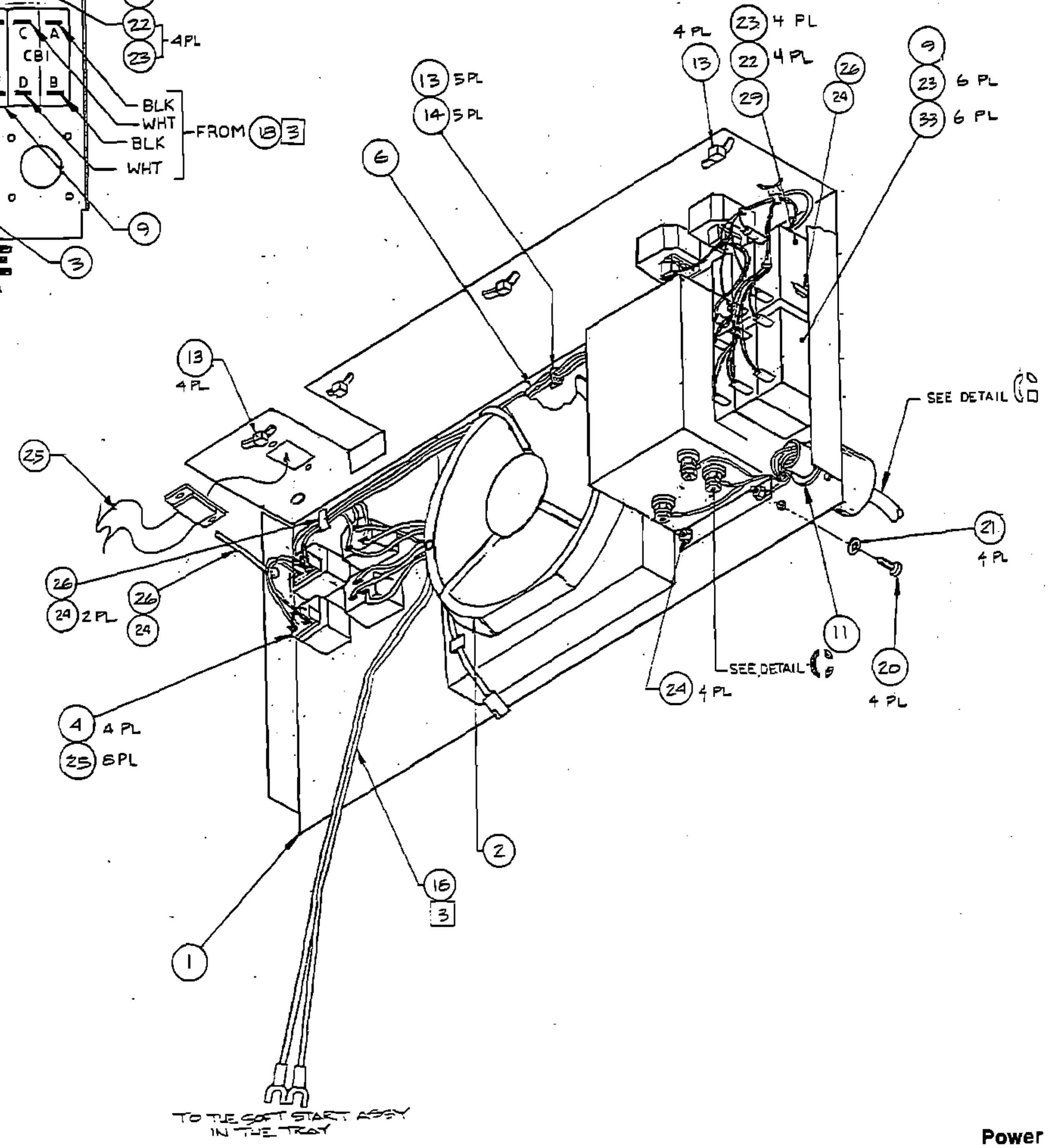
AS OF 12/06/90

22482 POWER SUPPLY REAR PANEL ASSEMBLY, INTERNATIONAL

PART NUMBER	DESCRIPTION	RV	ITEM NO.	QTY PER ASSEMBLY
24218	WELD'T LPS R-PNL, 220V XP	B	1	1.000
18480	FAN, 6 INCH, 12 VOLT, W/TACH	A	2	1.000
13306	FILTER,CM INPUT	A	3	1.000
13312	RECPT.FEM.POWER IEC PNL.MTG.	2	4	6.000
13617	CABLE ASSY, SYS PWR, INT'L 1B	B	5	1.000
15437	STRAIN RELIEF CASE 64 CHANNEL	C	6	1.000
12082	CLAMP, PAINTED CABLE	4	7	1.000
12089	SHELL, STRN RLF PAINTED	2	8	1.000
17908	CIRCUIT BKR,12.5A AUX TRP COIL	1	9	1.000
11255	FILTER, EMI, 10 AMP	A	10	1.000
12036	GROMMET, CABLE FEEDTHRU	A	11	1.000
16781	ASSY, BLEEDER FCI FILT INT'L	A	12	1.000
13753	TIE MOUNT, CABLE	1	13	9.000
11721	CABLE TIE, 3/4 DIA	A	14	7.000
11888	RECPT, 3 POS MOLEX, .093	A	15	1.000
19299	TERM F CRMP .093"D 24-22AWG	A	16	3.000
22536	HARNESS, NON-ISO, 220V PH2B	C	18	1.000
22537	HARNESS, ISO-AC, 220V PH2B	C	19	1.000
12293	SCR, 4-40X1/4 PH PN NYPATCH ZN	A	20	4.000
12164	WSHR, #4 LK INT TOOTH ZN	1	21	4.000
13773	SCR, 6-32X1/4 PH PN NYP	1	22	4.000
12278	WSHR, #6 NYLON	A	23	10.000
11875	KEPNUT, 8-32 STEEL ZNC	B	24	7.000
12505	SCR 4-40X5/16 PHL STD FLT ZINC	A	25	12.000
17084	CLAMP TIE, #10	A	26	4.000
12683	SCR,10-32X1/2 PH PN NYPATCH ZN	A	27	1.000
11871	WSHR, #10 FLAT ZN SAE	A	28	1.000
16412	CKT BKR,5A,2 POLE,.250 TAB	A	29	1.000
19140	STNDF, ALUM 6-32 1/4 HEX .500L	A	30	2.000
13259	WSHR, #10 INT'L TOOTH ZINC	A	32	1.000
11684	SCR, 3MMX6MM PH PN STD ZN	A	33	6.000
11885	CCLAMP,CABLE,3/16 #10SCR,NYLON	A	34	1.000
24352	PCB ASSY, LED DISPLAY BOARD	A	35	1.000
18773	HARNESS, ISO-AC TO TRAY, INTL	C	36	1.000

REV	ZONE	ECO NO	REVISIONS-DESCRIPTION	DATE	APPROVED
A		23139	PROD REL		





NOTES: UNLESS OTHERWISE SPECIFIED

1. REFERENCE DESIGNATIONS SHOWN ARE FOR REFERENCE USE AND MAY OR MAY NOT APPEAR ON THE ACTUAL PART.

[2] CUT WIRES TO 10" FROM THE RIM OF THE FAN. INSERT THE RED WIRE TO PIN 1,9 THE BLACK WIRE TO PIN 3 OF ITEM (9) & THE YELLOW WIRE TO PIN 2.

[3] USE DRAWINGS 22536 & 22537 TO DETERMINE LOCATIONS & TERMINATIONS.

[4] USE HARDWARE FROM ITEM (2).

Figure 9-21
Power Supply Rear Panel, International-sheet 1

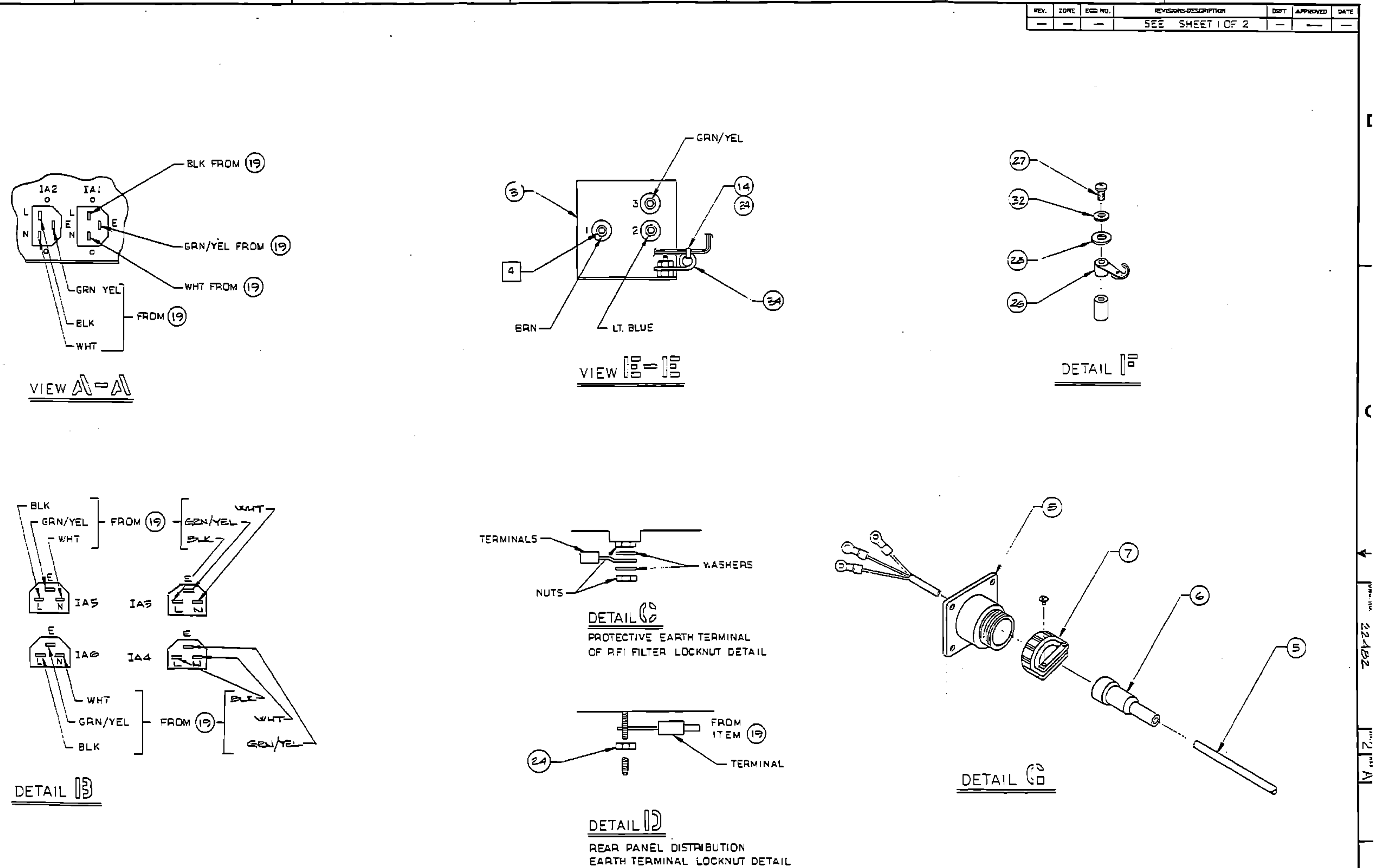


Figure 9-22
Power Supply Rear Panel, International-sheet 2

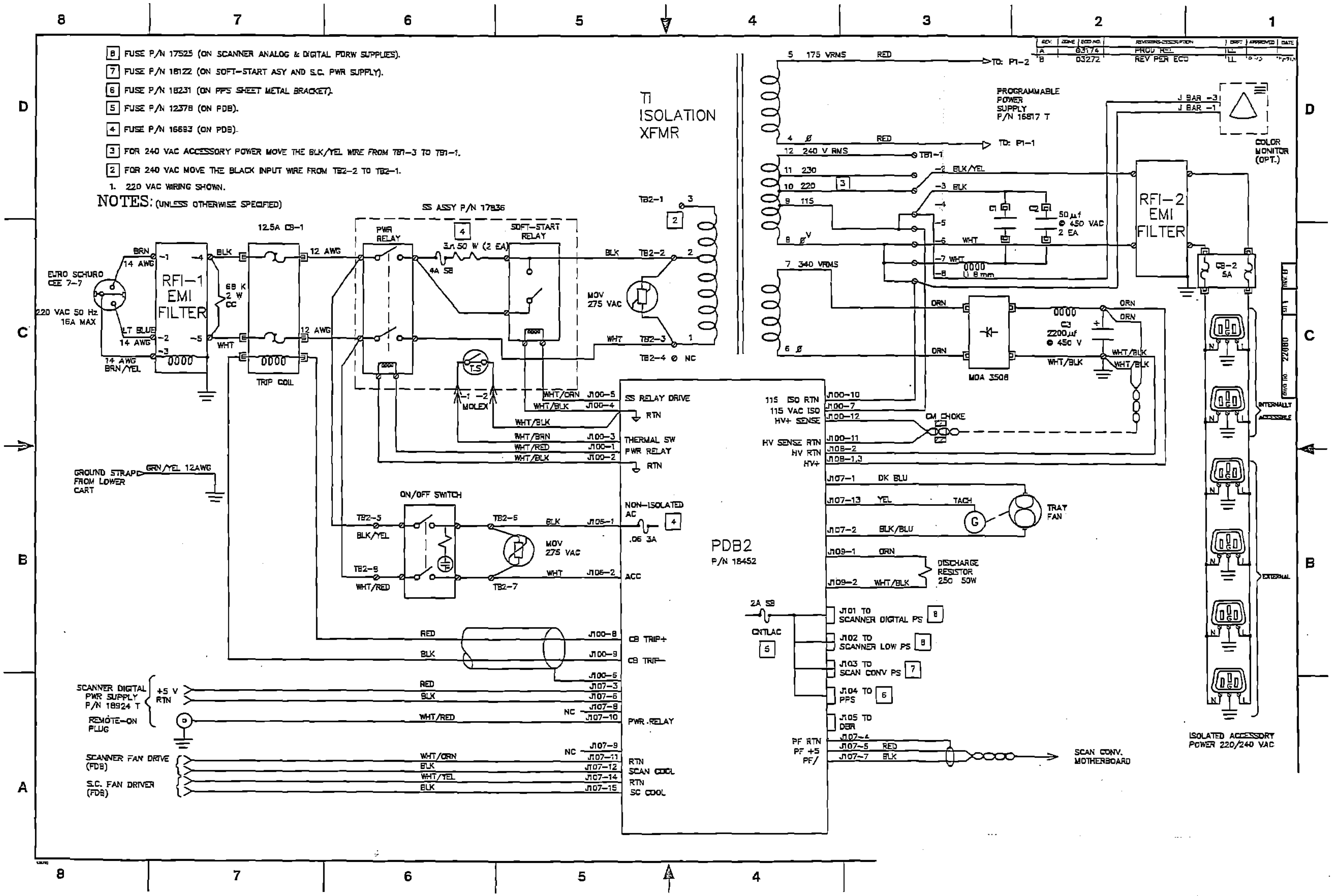


Figure 9-23
AC Power Distribution, International

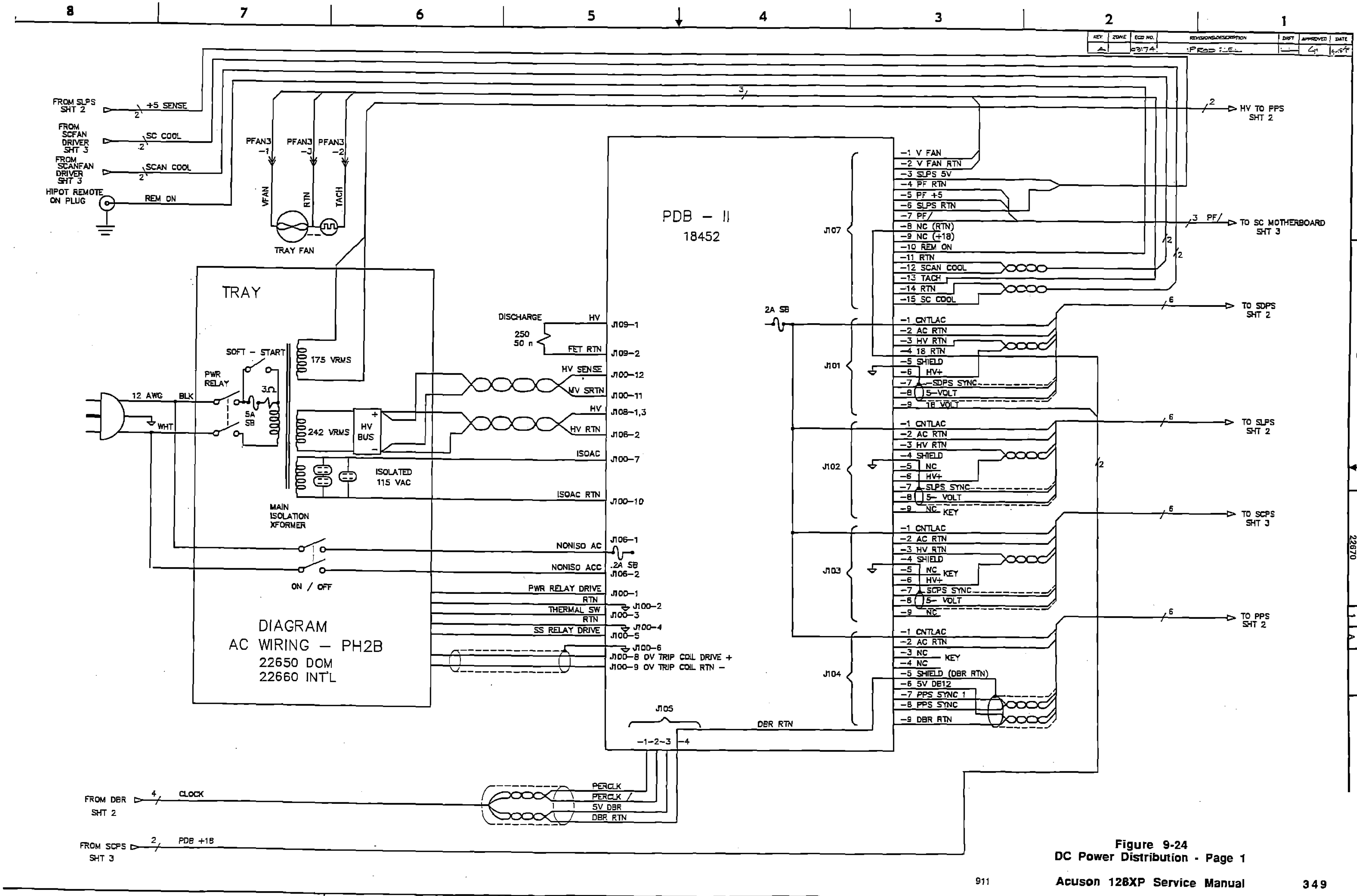


Figure 9-24
DC Power Distribution - Page 1

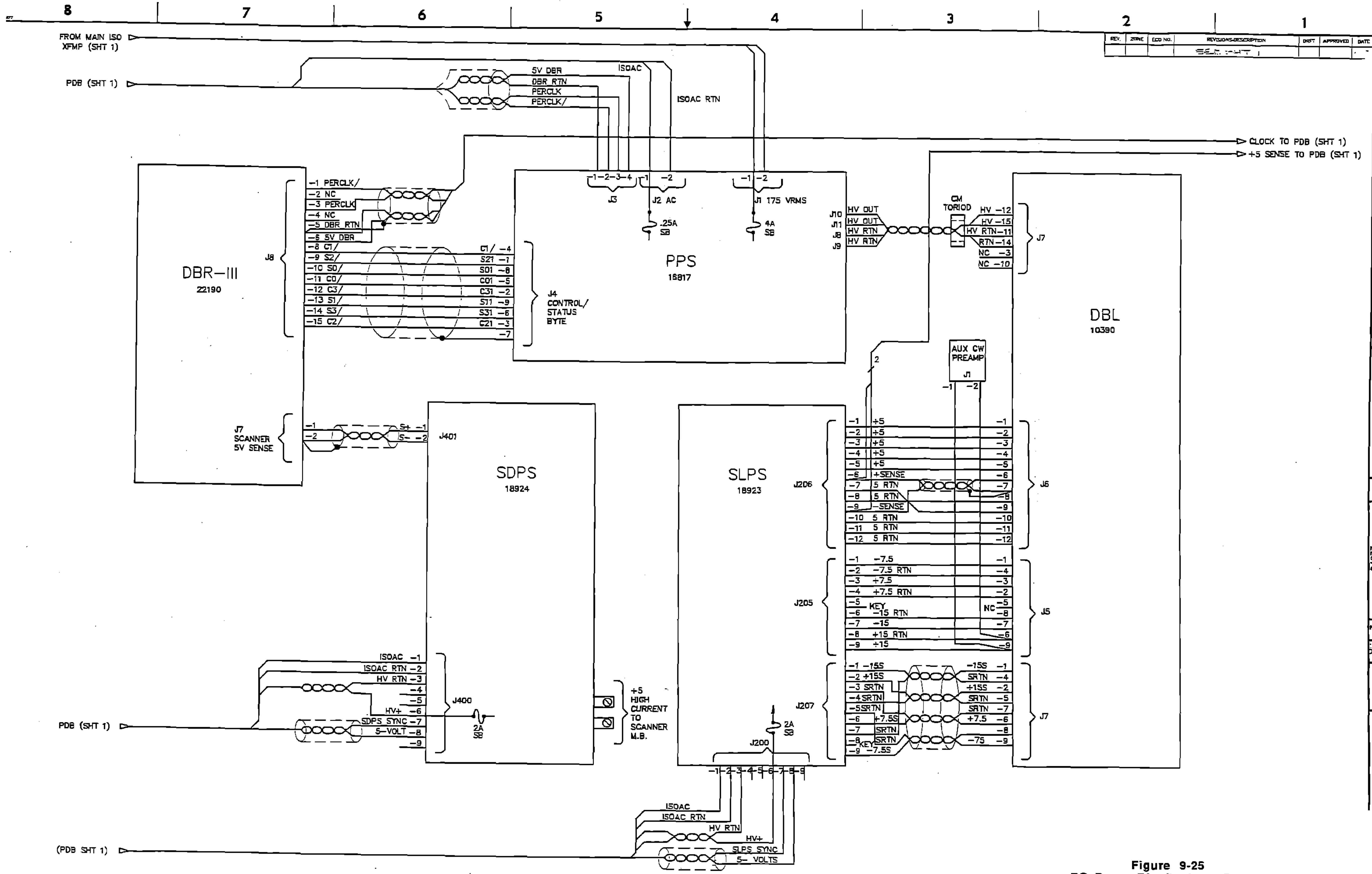


Figure 9-25
DC Power Distribution - Page 2

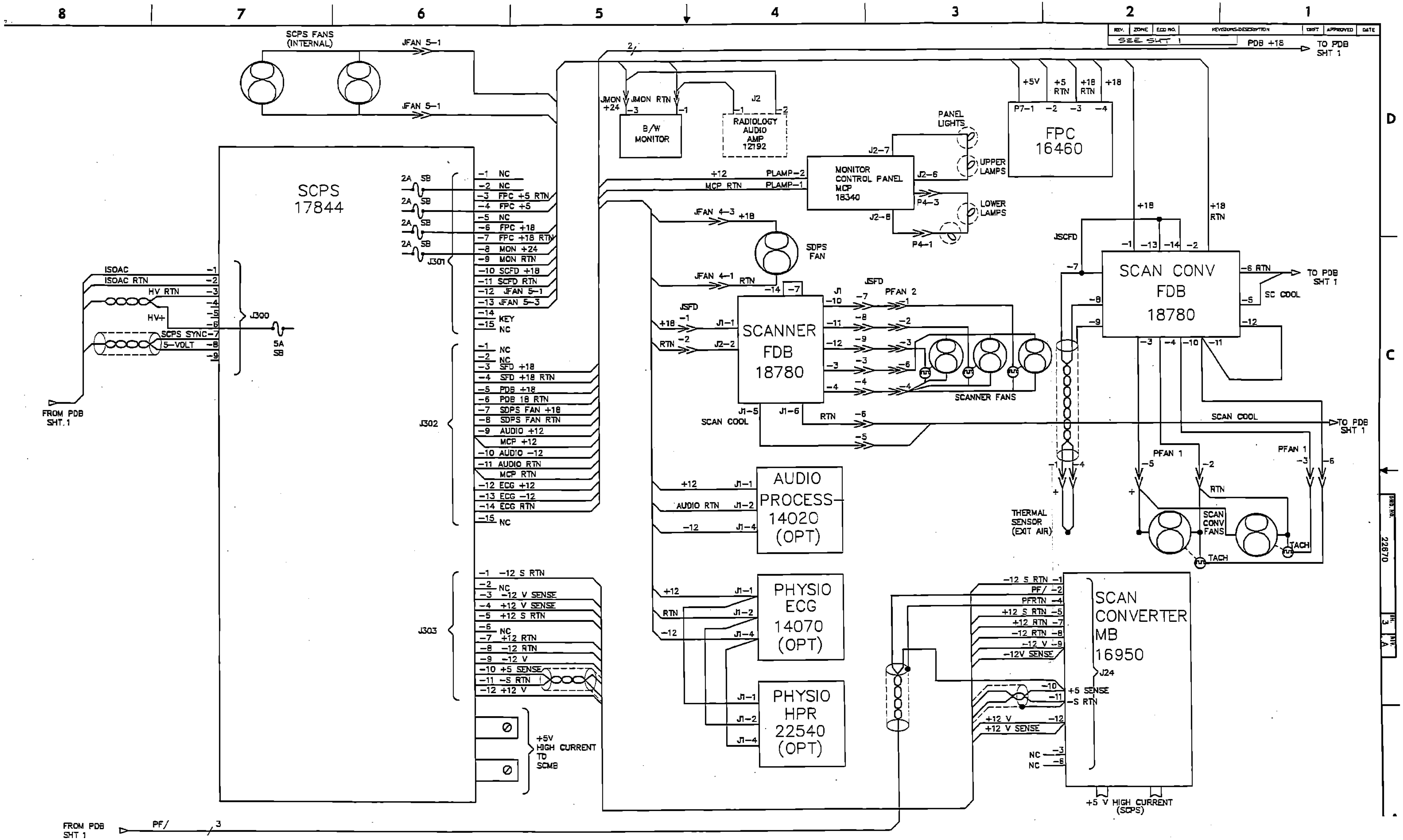


Figure 9-26
DC Power Distribution - Page 3

SECTION 10
Glossary

APD	Apodizer printed circuit board. Four of these are located in the Scanner card cage.
apex	In sector format, the apex is the pointed end of the image. The apex is adjacent to the transducer face.
apex invert	See up/down invert.
Application	Application specific programs contained in the Acuson system to make selecting scanning parameters simpler and faster.
Array CW	See CW Doppler.
artifact	Any anomaly that appears in the ultrasound image.
AUD	Audio Processor circuit board. Located beneath the upper cart. Converts Doppler I and Q signals to left and right audio. Drives speakers, headphones, accepts microphone input and handles VCR audio I/O.
AUX	Auxiliary Continuous Wave Doppler circuit board. Generates transmit pulses for the AUX CW probe. Also does initial signal processing for the AUX CW probe and CW Doppler.

AUX RCV	Auxiliary Receive. A signal that may be injected into the Scanner via a BNC connector on the DBL. It is used for the AUX CW Doppler transducer signal.
AUX XMT	Auxiliary Transmit. A transmit signal output from the Scanner via the DBL. It is used to drive the AUX CW Doppler transducer.
AUX CW	Auxiliary Continuous Wave Doppler. In this mode a single element, non-imaging transducer is used to collect Doppler information. See CW Doppler.
B-color	A feature that extends the dynamic range the human eye can perceive, allowing you to better perceive the wider dynamic range of echoes.
battery-backed RAM	Battery-backed Random Access Memory. Located on the Video Controller or Color Video Controller, this is where user programs are stored.
BBQ	Base Band Quadrature circuit board. One of these is located in the Scanner. It generates the I and Q signals used to process Doppler information.
beamformer	A subset of the circuit boards in the Scanner. Included are 16 Receivers (RCV), 8 Transmitters (XMT) and 8 Summing Delay Line (SDL) circuit boards.

beamformer driver	A subset of the circuit boards in the Scanner. Included are 8 Transmit Delay (XDY), 4 Apodizer and 4 Mixer Clock (MXK) circuit boards.
camera bay	The large open area in the Acuson 128XP. Accessed from the front, this is the usual location for bulky recording devices such as multi-image cameras and strip chart recorders.
CDI	Color Doppler Imaging. The process of displaying Doppler information in color. It is generally used to visualize the flow of blood in veins and arteries.
CED	Color Encoder/Decoder circuit board. Located in the Scan Converter of Color Doppler systems. Encodes and Decodes composite, component and Y/C video to/from RGB video.
Cine	An option on the Acuson 128XP that allows the most recent frames of data to be replayed. Replay speed and the number of stored frames can be adjusted. This option is useful when viewing repetitive motions such as the cardiac cycle.
CMB	Cine Memory Board. Located in the Scan Converter, this board is used in lieu of a MMB to support the Cine option. This board continuously stores the images most recently displayed on the monitor. These frames may then be played back. Especially useful in cardiac imaging.

Color Doppler	See "CDI".
color flow	See "CDI".
Color M-mode	An option available for use with the Color Doppler Imaging Option to obtain timing information from the color Doppler display.
common cart	A term used to describe the upper cart (Scan Converter) of systems which have an expanded version of the SCMB necessary to accommodate the Color Doppler Imaging Option.
component video	Video format in which brightness (luminance) and color (chrominance) information is separated. This video format is available for use with Super VHS video recorders. Resolution can be as high as 400 horizontal lines.
composite video	Video format in which all the information needed to construct a video image (Luminance, chrominance, and sync) is contained in a single video signal. Resolution is limited to 240 horizontal lines.
Computed Sonography	Acuson's process of transmitting, receiving, and processing ultrasound by the DCLS (Dynamic Computed Lens System). Parameters are fully under the control of software and can be continuously modified. Included are tracking focus, tracking aperture, tracking apodization and transmit zone enhancement.

CRT	Cathode Ray Tube. Also known as a monitor or TV screen.
CSC	Color Scan Converter. Located in the Scan Converter. The CSC changes the color scan format to video format. It also synchronizes the color Doppler information with the raster of the monitor.
CSI	Common System Interconnect. Located in the Scan Converter, all signal and data connections with the Scan Converter are made through this board. This board is used in lieu of a System Interconnect board (SIB) in systems that have a "Common Upper Cart".
curved array format	Formal name is "High Performance Curved Linear Array" Scan format in which each ultrasound line is fired perpendicular to the curved face of a transducer producing an image with a wider far field than near field.
CVC	Common Video Controller. Located in the Scan Converter, this board overlays 2-D ultrasound data, spectral Doppler data, graphics and alpha-numeric information and generates a RGB video signal.

CW Doppler	Continuous Wave Doppler. A mode of operation of the Acuson 128XP whereby some of the transducer elements are continuously fired and some transducer elements are configured to continuously receive Doppler data. With some transducers, the angle of the CW ultrasound line may be set relative to the face of the transducer. CW Doppler operation may be suspended briefly to allow periodic updates to the 2D image
DAQ	Doppler Acquisition Board. Located in the Scan Converter, this board digitizes the I and Q signals from the BBQ. The digitized data is then passed to the DSP.
DBL	Distribution Board Left. Located in the Scanner, this board provides the interface for the analog Scanner signals. BNC connectors are provided to monitor some of these signals. DC power connectors for the Scanner are plugged into the DBL.
DCC	Dual Channel Controller. Two of these are located in the Scanner, this board is used to rapidly update the set-up parameters for each of the Scanner circuit boards for each ultrasound line.
DCLS	Dynamic Computed Lens System. Descriptive name for the Scanner. The DCLS is fully under control of software and can be continuously modified. Included are tracking focus, tracking aperture, tracking apodization and transmit zone enhancement. See Computed Sonography.

DCP	Display Control Processor. Located in the Scan Converter, this board generates graphics for Doppler and other special operations.
DGC Pots	Depth Gain Compensation Potentiometers. These are the slide controls on the front of the system. They allow the operator to modify the gain vector used by the Scanner.
DL connector	Dual Locking Connector. A 156-pin connector that allows rapid connection of any of Acuson's transducers to the Scanner.
Doppler	The effect whereby the frequency of a wave is affected by motion of the source. In the case of ultrasound, the frequency of a transmitted ultrasound wave is shifted by bouncing off a moving structure. The velocity of the structure may be derived from the difference between the transmit frequency and the received frequency.
DPR	Dual Port RAM. Circuitry located in the Scanner on the DBR circuit board. All digital information is transferred between the Scanner and Scan Converter via the DPR.
dropout	An area of missing data on the image. It may be a single pixel, a single line or an extended area.

DSP	Doppler Spectral Processor circuit board. Performs a fast Fourier transform on the digitized I and Q signals from the DAQ. Frequency data is then sent to the Input Controller. Data is also passed to the Audio Processor.
ECG module	A monitoring module with an ECG channel and auxiliary channel.
EPROM	Erasable Programmable Read Only Memory. An integrated circuit used to store Acuson software
ER transducer	Endorectal transducer. A class of transducers including the I7145, I7146 and the I7505.
EV transducer	Endovaginal transducer. Otherwise known as the EV519.
far field	The area of the image farthest from the transducer.
FDB	Fan Driver Board. Senses fan speed and temperature and will shut the system off if the temperature is excessive or if the fans stop rotating.
FEB	Flow Estimator Buffer circuit board. Estimates color Doppler parameters based on the color Doppler data received from the FEC. Also stores the last 32 frames of color data for display in CINE mode.

FEC	Flow Estimator Calculator circuit board. Performs initial processing of digitizeed Doppler data from the DAQ. Data is then passed to the FEB for further processing.
Flow	See "CDI".
focal zone	The depth at which the transmitted ultrasound beam is most focused.
FPC	Front Panel Controller circuit board. Located beneath the keyboard, this board provides the interface between the keyboard, switches, gain pots, etc. and the Scan Converter. Analog information from DGC pots and gain pots is digitized on this board.
frame	Data from a number of ultrasound lines that make up a single image.
IC	Input Controller circuit board. Located in the Scan Converter, this board digitizes the ultrasound signal from the Scanner. This information is then sent to the MMB or CMB.
IF FIL	Intermediate Frequency; Filtered. Term to describe the IF signal after high frequency components of the mixing operation have been filtered out by the VDT. This signal is then passed to the BBQ.
IF signal	The ultrasound signal after it has been mixed and all 128 channels have been summed together.

IF SUM	See "IF signal".
IGD	Interpolating Gain Driver circuit board. This board generates the analog gain signals for the RCV's and VDT. This is derived from the microcode for each transducer, the master gain control and the DGC controls.
imaging CW	See CW Doppler.
I/O panel	Input/Output Panel. A panel on the back of the Acuson 128XP that provides connectors for various I/O devices, including VCR's, SCR's multi-image cameras, page printers and computer printers.
keyboard	Input device on the operator panel. It is used to enter alpha-numeric information into the Acuson 128XP. By pressing the CODE key a number of tertiary functions may also be accessed.
LED	A solid state indicator lamp.
left/right invert	A feature which moves the left side of the image to the right side of the screen.
lighted switch board	Input device on the operator panel. Used to activate often used functions such as "FREEZE", "PRINT","RES", etc.
linear format	A format whereby each ultrasound line is fired perpendicular to the transducer face. All the lines are therefore parallel with each other. The image area appears as a rectangle on the monitor.

lower cart	The lower chassis of the Acuson 128XP. It contains the Scanner and power supply drawer.
M-mode	Motion-Mode. A display format whereby data from a single ultrasound line is repeatedly displayed on a time scale. This allows easy measurement of moving structures such as heart valves.
MEMEX	See MEX.
MEX	Memory Expansion circuit board. Up to three of these may be installed in the Scanner. This board is used to hold the PROM's containing the microcode for each of the transducers. One of the SCP PROM's is also installed on the MEX. This board is also known as a MEMEX.
microcode	In the Acuson 128XP microcode refers to the PROM's containing the set-up parameters used by each transducer. These are installed on the MEX.
mirroring	An artifact that appears on the Doppler spectral strip. It consists of a "phantom" Doppler signal of equal velocity but opposite direction from the true Doppler signal.

MMB	Main Memory board. Located in the Scan Converter, this board stores an entire frame of ultrasound data. Single lines of data are loaded by the Input Controller. The Output Controller reads data in the MMB in synch with the monitor raster. This board is not used when the Cine option is installed on the system.
monitor	The video display on the Acuson 128XP.
motherboard	A term to describe a circuit board that provides the interconnection between a number of circuit boards. The Acuson 128XP has two, the Scanner Motherboard (SMB), and the Scan Converter Motherboard (SCMB).
MultiHertz	A feature that allows two frequencies on one transducer.
MXK	Mixer Clock circuit board. Four of these are located in the Scanner. They provide the mixer signals used to convert the ultrasound signal to an IF signal.
near field	Area of the image adjacent to the transducer face.
needle guide	A device that attaches to a transducer to position a needle precisely relative to the transducer. Mode of operation that overlays the estimated path of the needle on the image. Needle insertion can be viewed on the monitor.

NTSC	National Television Standards Committee. Committee formed in 1950 to define standards for color TV broadcasts. These standards are still used in North America and elsewhere. Acuson ships domestic units with this format.
OC	Output Controller circuit board. Located in the Scan Converter, this board reads ultrasound data out of the MMB in synch with the Video raster. The processor that controls the Scan Converter and I/O functions is also located on the OC.
page printer	A device that converts the video output of the Acuson 128XP to a hardcopy without using optics.
PAL	Phase Alternate Line. A video standard adopted by a majority of countries in 1967. PAL has 625 lines of video. Acuson ships international systems with this format.
PCB	Printed Circuit Board. A fiberglass board with circuit paths. Electronic components are soldered to the board. The Acuson 128XP is designed such that each PCB is a replaceable assembly. It is not recommended that components be replaced on the board.
PDB	Power Distribution Board. Located in the power supply drawer, this board controls the power-on cycle of the system, senses fault conditions on the AC power line and shuts down the system if a fault is detected.

PEM	Program Expansion Module circuit board. The PEM is a half height PCB located in the Scan Converter. It provides extra PROM sockets for operating system software. The CVC replaces the PEM and provides these sockets for systems so equipped.
peripheral	See recording device.
Physiologic Module	Also called Physio Module. A monitoring module with a phono channel that is used for a heartsounds trace or a DC input and a pulse/respiration channel that is used for a pulse trace, respiration trace or DC input.
piezo-electric effect	The property which causes a crystalline material to change its physical dimensions when an voltage is applied. Conversely, when pressure is applied to the crystal a voltage is generated. 128 separate piezo-electric elements are used in Acuson's transducers.
power supply	A device that converts 115 Volts AC power (220 Volts AC for international systems) to a low DC voltage (e.g. 5 VDC, 15 VDC, etc).
power supply drawer	A drawer at the base of the Acuson 128XP containing the power supply control circuitry, some of the power supplies, the main power transformer, and related devices.
PPS	Programmable Power Supply. A power supply whose output can be set by the Scanner. It is used to power the transducer during the transmit cycle. Maximum voltage is 150 VDC.

PROM	Programmable Read Only Memory. A integrated circuit "chip" that is used to store information or programs.
Pulsed Wave Doppler	PW Doppler. A mode in which an ultrasound line is fired and the frequency shift of the echo is sampled only at a particular depth along the line. Data is thus collected only at a particular segment of the line. The spectral data is then displayed on the monitor or output through the speakers.
quadrature	A means of encoding AC signals that retains the amplitude and phase information. The signal is processed to produce two signals, in-phase or I which is the same as the original and quadrature or Q which is phase shifted by 90°.
RAM	Random Access Memory. Integrated circuit "chips" that store data. They can be written to and read from.
RCV	Receiver circuit board. Sixteen of these are located in the Scanner, each amplifies the signals from eight of the transducer elements and converts the signal to an IF signal.
recording device	A device that attaches to the Acuson 128XP. May include VCR's strip chart recorders, cameras, page printers, etc.

reverb. artifact	A phantom structure or distortion displayed on the monitor caused by receiving multiple reflections from a single structure. See "reverberation".
reverberation	Multiple internal reflections of the ultrasound beam. For instance, when imaging in the cranium of a neonate with hydroencephaly. The ultrasound beam is strongly reflected by the cranium and is not attenuated much by the fluid. The beam may "reverberate" or reflect back and forth several times.
RGB	A video format in which the red, green, blue and sync components of the video signal are separated. This format is used internally in Acuson's color systems and an output is provided to connect with peripherals that using this format.
ringdown	A bright region in the near field of an image caused by the initial impulse of transmitted ultrasound energy.
Scan Converter	The part of the Acuson 128XP that converts the analog ultrasound data to a format compatible with the monitor raster pattern. It also controls I/O operations. It is located in the upper cart.
Scanner	The part of the Acuson 128XP that controls the 128 transducer elements in concert to form a focused ultrasound beam. Echoes from each of the receivers are amplified, phased and added together to form a dynamically focused receive signal.

SCM	Strip Chart / M-mode circuit board. Located in the Scan Converter the SCM handles operation of the strip chart recorder including output of video data. It also controls the cardiac M-mode cycle.
SCMB	Scan Converter Motherboard circuit board. A multi-layer impedance matched circuit board used to interconnect all the circuit boards in the Scan Converter.
SCP	Scanner Control Processor circuit board. The control processor for Scanner. Handles the set-up of the Scanner for each ultrasound line. Also, writes data to the dual port RAM on the DBR to allow communication with the Scan Converter.
SCR	Strip Chart Recorder. Thermal printing device particularly useful for displaying spectral Doppler and M-mode data.
SDL	Summing Delay Line circuit board. Eight of these boards are used in the Scanner to adjust the timing of the received ultrasound signal from each of the transducer elements.
sector format	Scan format in which each ultrasound line is fired at a unique angle from the same point of origin on the transducer face. The resulting pattern appears as a sector of a circle.

SGD	Scan Gain Driver circuit board. Located in the Scanner, this board works in conjunction with the SGI. Provides the gain control signal to each of the receivers and the VDT. SGI and SGD can be replaced by a single IGD.
SGI	Scan Gain Interpolator. Develops a gain curve based on transducer microcode, master gain setting and DGC settings. It is used in conjunction with an SGD. The SGI and SGD may be replaced by a single IGD.
SI	System Interconnect circuit board. Located in the Scan Converter, all signal and data connections with the Scan Converter are made through this board. This board is used in lieu of a Common System Interconnect board (CSI) in non-common cart systems.
sidebanding	An artifact that may appear in the Doppler spectral strip. It appears as a horizontal line at a particular velocity. It may be the result of harmonic noise in the system or RFI in the environment..
SMB	Scanner Motherboard circuit board. A multi-layer impedance matched circuit board used to interconnect all the circuit boards in the Scanner.
soft keys	Located below the monitor on the front panel, these keys perform different functions based on the current set-up of the Acuson 128XP. The function of each key is displayed at the bottom of the monitor.

software	The instructions the computer uses to operate.
sonography	The process of obtaining images of internal anatomy using high frequency sound waves.
spectral Doppler	A format for the display of Doppler data. Frequency data is displayed on the vertical axis. Time is displayed on the horizontal axis.
steerable CW	See CW Doppler.
STG	Scanner Timing Generator circuit board. Located in the Scanner, this board generates all the clock signals used in the Scanner.
super VHS	See SVHS.
SVHS	A video format which utilizes separate chrominance and luminance signals. The luminance carrier bandwidth is 5.5 MHz allowing a resolution of 400 horizontal lines (standard VHS uses 3.2 MHz). Signal/noise ratios are higher and because chrominance and luminance signals are separate cross-color and cross-luminance distortion is eliminated.
SYSCON	The operating software used by the Acuson 128XP. It is executed by the OC. The PROM's containing SYSCON are located on the OC and the CVC or PEM if no CVC is installed.

TDI	Transducer Interconnect board. Located in the Scanner, this board has one or two DL connectors with which the transducers are connected to the Scanner.
TE	Transesophageal transducer, otherwise known as the I5100.
TER	Terminator circuit board. Bus terminator circuitry for the Scanner. Usually called TRM.
tertiary controls	Controls used to set up system configuration. These controls are labeled in blue on the keyboard. Each function is activated by pressing CODE and then the appropriate key.
TLA	Three-Letter Acronym or on some Scan Converter boards, Two-Letter Acronym, or as with the SCMB, Four-Letter Acronym. Shorthand designators for circuit boards used in the Acuson 128XP.
Transperineal needle guide	Needle guide suitable for use with either the I7146 or the I7505 endorectal transducers. The biopsy needle is inserted via the perineum.
trackball	Input device on the operator panel. It is used to input positional information such as cursor position or tracing displayed data for use in calculation options.

transducer	An array of 128 piezo-electric transducer elements used to convert electrical energy into sound waves and sound waves back to electrical energy.
Transducer Switch	An option which permits the selection between transducers connected to the two DL ports.
TRM	Terminator circuit board. Bus terminator circuitry for the Scanner. TER is sometimes used instead of TRM.
TV	Transvaginal. An obsolete term for the I5196 transducer. See EV.
ultrasound	Extremely high frequency sound waves. Acuson operates between 2.5 and 7 MHz
up/down invert	A feature in which the top of the image appears at the bottom of the screen. It is useful to display anatomies that would otherwise be perceived as "upside-down" (e.g. subcostal views of the heart).
upper cart	The top half of the Acuson 128XP. After removing the side panels from the lower cart and three screws, the upper cart may be tilted to the left (left side is hinged) to gain access to the Scanner section.
US VID	Ultra-Sound Video. Analog ultrasound signal after processing by the VDT. This signal is sent to the IC where it is digitized.

ultrasound line	A data returned from one one transmit pulse. Quality of an ultrasound line is determined by the quality of focus and the sensitivity to amplitude changes of the signal. An image is made up of a large number of individual ultrasound lines.
VC	Video Controller circuit board. Located in the Scan Converter, this board overlays 2-D ultrasound data, spectral Doppler data, graphics and alpha-numeric information and generates a composite video signal.
VCR	Video Cassette Recorder. Recording device used to record images on video tape. The Acuson may be configured for composite or component video formats. (See SVHS)
VDT	Video Detector circuit board. Located in the Scanner, this board creates a baseband video signal level that corresponds to the amplitude of the IF SUM signal. Log compression is also performed on this board.
Vector™ Array format	Scan format in which each ultrasound line originates from any point on the transducer face and can be steered in any direction, producing a wider field of view at all depths than the sector format.
VHS	Video format that utilizes a composite video signal, that is Luminance, Chrominance and Sync information is combined into a single signal. Horizontal resolution is limited to about 240 lines. Due to signal compression during recording luminance data is reduced.

VSOT	Virtual Start Of Transmit. Timing signal that initiates the transmit cycle.
XDY	Transmit Delay circuit board. Eight of these boards are located in the Scanner. These boards introduce a unique delay for each channel after VSOT is sent. The delays focus and aim the ultrasound transmit pulse.
XMT	Transmitter circuit board. Eight of these boards are used in the Scanner Each drives 16 channels of the transducer.
Y/C	A video format where luminance (Y) and chrominance (C) signals are processed separately. This format is used in SVHS systems.

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